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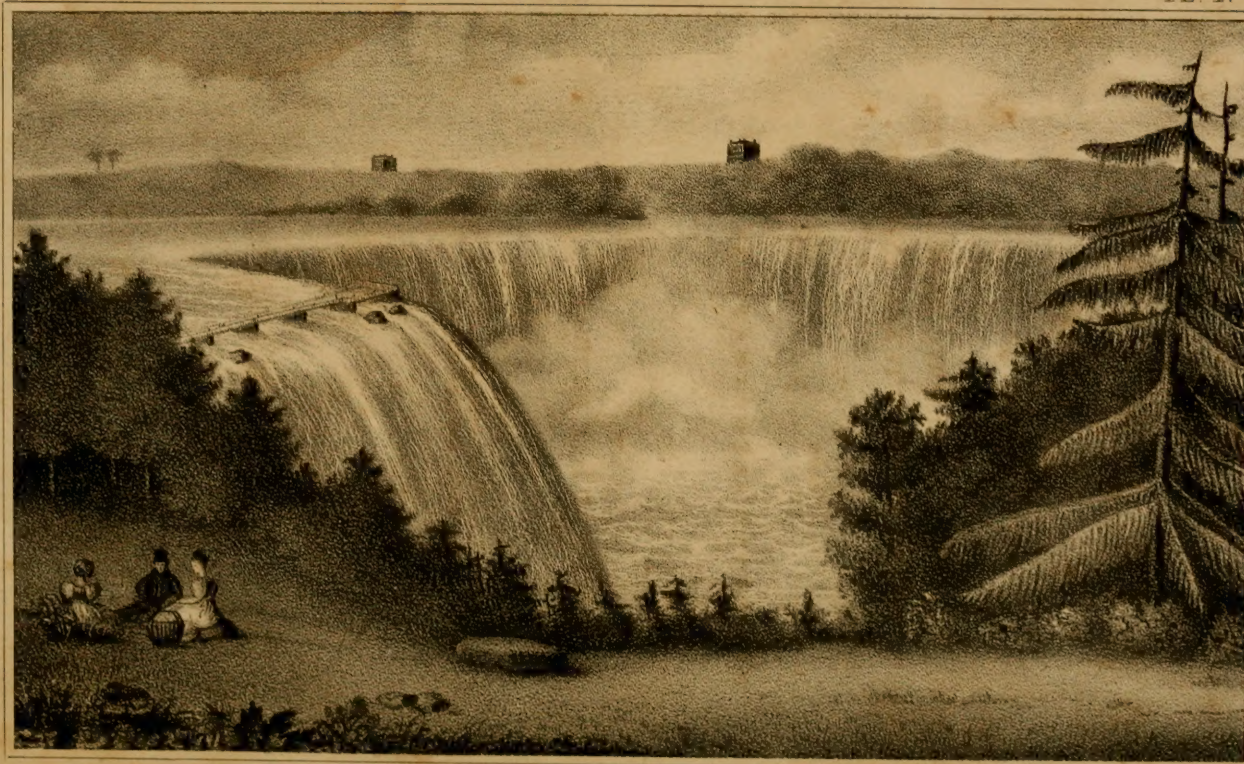

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NIAGARA FALLS FROM GOATS ISLAND

THE

NATURALIST,

CONTAINING TREATISES ON

NATURAL HISTORY, CHEMISTRY, DOMESTIC AND RURAL ECONOMY, MANUFACTURES, AND ARTS.

WITH

NUMEROUS ILLUSTRATIONS.

EDITED BY D. J. BROWNE.

——'Plants, trees and stones we note;
Birds, insects, beasts, and rural things.'

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CONTENTS.

List of Works consulted in the Compilation of this Volume, which were not enumerated in the First Volume.

Buffon's Natural History by Goodrich—Comb's Phrenology—Edinburgh Review—First Lessons in Natural History—Gall and Spurzheim's Phrenology—Gould's Companion to the Microscope—Jackson and Alger's Mineralogy and Geology of Nova Scotia—Lardner's Cabinet Cyclopædia—London Examiner—Montague's Ornithological Dictionary by Rennie—Moubray on Poultry by Fessenden—Nuttall's Ornithology—Phrenological Journal—Silliman's Journal—Spurzheim's Phrenology—Sylva Americana—Token for 1832—Young Lady's Book.

Corrections to be made with a Pen.

Page 17, line 3, transpose $900, and $450.
" 130, " 31, for *Tarquenius* read *Tarquinius*.
" 140, " 9, for *inter-susception* read *intus-susception*.
" " " 12, for *that* read *what*.
" 156, " 27, for *always* read *generally*.

From page 329 to 346, the first figures indicating the number of the pages should read 3.

THE NATURALIST.

JANUARY, 1832.

FALLS OF THE NIAGARA.

BY F. W. P GREENWOOD.

The voice of the Lord is upon the waters; the voice of the glorious God; the Lord thundereth over the great waters.

PSALM xxix. 3. *Old Translation.*

THERE is a power and beauty, I may say a divinity, in rushing waters, felt by all who acknowledge any sympathy with nature. The mountain stream, leaping from rock to rock, and winding, foaming and glancing through its devious and stony channels, arrests the eye of the most careless or business-bound traveller; sings to the heart and haunts the memory of the man of taste and imagination, and holds, as by some undefinable spell, the affections of those who inhabit its borders. A waterfall, of even a few feet in height, will enliven the dullest scenery, and lend a charm to the loveliest; while a high and headlong cataract has always been ranked among the sublimest objects to be found in the compass of the globe.

It is no matter of surprise, therefore, that lovers of nature perform journeys of homage to that sovereign of cataracts, that monarch of all pouring floods, the Falls of Niagara. It is no matter of surprise, that, although situated in what might have been called, a few years ago, but cannot be now, the wilds of North America, five hundred miles from the Atlantic coast, travellers from all civilized parts of the world have encountered all the difficulties and fatigues of the path, to behold this prince of waterfalls amidst its ancient solitudes, and that, more recently, the broad highways to its dominions have been thronged. By universal consent it has long ago

been proclaimed one of the wonders of the world. It is alone in its kind. Though a waterfall, it is not to be compared with other waterfalls. In its majesty, its supremacy, and its influence on the soul of man, its brotherhood is with the living ocean and the eternal hills.

I am humbly conscious that no words of mine can give an adequate description, or convey a satisfactory idea, of Niagara Falls. But having just returned from a visit to them,* with the impression which they made upon my mind fresh and deep, I may hope to impart at least a faint image of that impression to the minds of those who have not seen them, and re-touch, perhaps, some fading traces in the minds of those who have. And if I can call the attention of any to this glorious object as a work of God, and an echo of the voice of God; if by any thing which I may fitly say of it, I can quicken the devotion of one breast, I shall feel that I have fulfilled a sacred duty, and that I have not unworthily expressed my sense of obligation for having been permitted to behold it myself.

I will not begin my description with the cataract itself, but take you back to the great lake from which the Niagara flows, so that you may go down its banks as I did, and approach the magnificent scene with a knowledge regularly and accumulatively gained of its principal accessaries. For the river and the lake, nay, the whole superb chain of rivers and lakes, should be taken into view, when we would conceive as we ought of the Falls of Niagara.

As we approach the town of Buffalo, which is situated near the eastern extremity of Lake Erie, that wide spread sheet of water opens to the sight. If the traveller has never seen the ocean, he may here imagine that he sees it. If he has, he will say that it is a sea view which here lies before him. As he looks to the west, the horizon only bounds the liquid expanse; and it is not till he descends to the shore, and marks the peculiar, quiet and exact level of the even and sleeping lake, that he will find any thing to remind him that he is not on the coast of the salt and swelling sea. Four miles north from Buffalo we come to the vilage of Black Rock ;† and it is here that the boundaries of the lake contract, and its waters begin to pour themselves out through the sluceway

* The visit was made with some friends, in July, 1831.

† According to Mr. Featherstonhaugh, editor of the Monthly American Journal of Geology and Natural Science, the 'seams and patches of dark-colored chert contained in the beds of carboniferous limestone,' have furnished its name to this vilage.

of the Niagara river. The river is at this place about a quarter of a mile broad; and, as I gazed on its dark and deep and hurrying stream, I felt a sensation of interest stealing over me, similar to that which I have experienced in reading of the preparations of men for some momentous expedition. Opposite Black Rock, on the Canada side, is the village of Waterloo, to which we were ferried over, and from which we commenced our ride down the river, which runs north into Lake Ontario. There is also a road on the American side, from Buffalo to the Falls, a distance, either way, of about fifteen miles.

From Waterloo we pass on by a level road, immediately on the western bank of Niagara, and observe that the river continually becomes wider, till at length it divides into two streams which sweep round an island several miles in length. They then unite again, forming one stream as before, only that it is increased in breadth and swiftness. And now the interest thickens, and begins to grow intense. Hitherto we had been travelling on the side of a large river, it is true, but one not much distinguished otherwise, either by its motion, its shape, or the beauty of its borders. We are obliged to call on ourselves to consider where we are, and whither we are going; for Niagara itself seems unconscious of the grand associations with which it is freighted. It moves as if unmindful, or as not caring to put the traveller in mind, that its waters have come down through the whole length of Erie from the far away Huron, Michigan, Superior; that they are just about to rush over the wondrous precipice below, and then are to hasten forward into another majestic lake, and from it are to pass through the portals of a thousand islands, and the alternate rapids and lakes of a noble and romantic river, washing the feet of cities,* and so to flow on into the all-receiving sea. We are obliged to remember this, I say; for the unpretending waters, though pressing forward continually and intently, have thus far told us nothing, themselves, of their long pilgrimage behind, or the yet more eventful journey before them. But here, as they are meeting round Grand Island, they break their silence and speak, and the whole scene becomes full of spirit and meaning. Here, about three miles from the Falls, you see the white crested rapids tossing in the distance before you. Here, even in the most unfavorable state of the weather, you hear the voice of the cataract, pervading the air with its low, monotonous, continuous roar. And here you see a column of mist rising up,

* Montreal and Quebec are both on the St. Lawrence.

like a smoke in distantly burning woods, and designating the sublime scene over which it is immediately hanging. I know not that I was afterwards more strongly affected, even by the Falls themselves, than I was by the sight of this ever changing and yet never absent guide, this cloudy pillar, this floating, evanescent, and yet eternal testimony, which pointed out to me the exact spot which had been for so many years as a shrine to thousands, which I had heard of and read of so long, and which I had myself so often visited, though not in person, yet with my reverential wishes, with my mind, and with my heart. Childhood came back to me, with its indistinct, but highly wrought and passionate images; maps were unrolled; books were opened; paintings were spread; measurements were recalled; all the efforts which the art of man had made, all the tributes which his spirit had offered, at the call of the great cataract; all these associations, with other dream-like thoughts of the wilderness, the lake, and the stream, rose up unbidden and with power within me, as I steadfastly regarded that significant, far off mist, and knew that I, too, was soon to stand on the consecrated spot, and see, and feel.

A mile or two is soon passed, and now we turn a little from the road to the right, in order to have a near view of the rapids. These occupy the whole breadth of the river, from shore to shore, and extend half a mile back from the Falls, and are formed by the rush of the entire body of waters down a rough bed, the descent of which in the course of this half mile is fifty feet. Here all is tumult and impetuous haste. The view is something like that of the sea in a violent gale. Thousands of waves dash eagerly forward, and indicate the interruptions which they meet with from the hidden rocks, by ridges and streaks of foam. Terminating this angry picture, you distinguish the crescent rim of the British Fall, over which the torrent pours and disappears. The wilderness and the solitude of the scene are strikingly impressive. Nothing that lives is to be seen in its whole extent. Nothing that values its life, ever dares venture it there. The waters refuse the burden of man, and of man's works. Of this they give fair and audible warning, of which all take heed. They have one engrossing object before them, and they go to its accomplishment alone.

Returning to the road, we ride the last half mile, ascending gradually, till we come to the public house.* A footpath through the garden at the back of the house, and down a

* Forsyth's Hotel.

steep and thickly wooded bank, brings us upon Table Rock, a flat ledge of limestone, forming the brink of the precipice, the upper stratum of which is a jagged shelf, no more than about a foot in thickness, jutting out over the gulf below. Here the whole scene breaks upon us. Looking up the river, we face the grand crescent, called the British or Horseshoe Fall. Opposite to us is Goat Island, which divides the Falls, and lower down to the left, is the American Fall. And what is the first impression made upon the beholder? Decidedly, I should say, that of beauty; of sovereign, majestic beauty, it is true, but still that of beauty, soul-filling beauty, rather than of awful sublimity. Every thing is on so large a scale; the height of the cataract is so much exceeded by its breadth,* and so much concealed by the volumes of mist which wrap and shroud its feet; you stand so directly on the same level with the falling waters; you see so large a portion of them at a considerable distance from you; and their roar comes up so moderated from the deep abyss, that the loveliness of the scene, at first sight, is permitted to take precedence of its grandeur. Its coloring alone is of the most exquisite kind. The deep sea-green of the centre of the crescent, where it is probable the greatest mass of water falls, lit up with successive flashes of foam, and contrasted with the rich, creamy whiteness of the two sides or wings of the same crescent; then the sober gray of the opposite precipice of Goat Island, crowned with the luxuriant foliage of its forest trees, and connected still further on with the pouring snows of the greater and less American Falls; the agitated and foamy surface of the waters at the bottom of the Falls, followed by the darkness of their hue as they sweep along through the perpendicular gorge beyond: the mist, floating about, and veiling objects with a softening indistinctness; and the bright rainbow which is constant to the sun—altogether form a combination of color, changing too with any change of light, every variation of the wind, and every hour of the day, which the painter's art cannot imitate, and which nature herself has perhaps only effected here.

And the motion of these Falls, how wonderfully fine it is! how graceful, how stately, how calm! There is nothing in it hurried or headlong, as you might have supposed. The eye is so long in measuring the vast, and yet unacknowledged height, that they seem to move over almost slowly; the central and most voluminous portion of the Horseshoe even goes down

* The height of the Horseshoe Fall is 150 feet; its breadth 2376 feet.

silently. The truth is, that pompous phrases cannot describe these Falls. Calm and deeply meaning words should alone be used in speaking of them. Any thing like hyperbole would degrade them, if they could be degraded. But they cannot be. Neither the words nor the deeds of man degrade or disturb them.—There they pour over, in their collected might and dignified flowing, steadily, constantly, as they always have been pouring since they came from the hollow of his hand, and you can add nothing to them, nor can you take any thing from them.

As I rose, on the morning following my arrival, and went to the window for an early view, a singular fear came over me that the Falls might have passed away, though their sound was in my ears. It was, to be sure, rather the shadow of a fear than a fear, and reason dissipated it as soon as it was formed. But the bright things of earth are so apt to be fleeting, and we are so liable to lose what is valued as soon as it is bestowed, that I believed it was a perfectly natural feeling which suggested to me for an instant, that I had enjoyed quite as much of such a glorious exhibition as I deserved, and that I had no right to expect that it would continue as long as I might be pleased to behold. But the Falls were there, with their full, regular and beautiful flowing. The clouds of spray and mist were now dense and high, and completely concealed the opposite shores; but as the day advanced, and the beams of the sun increased in power, they were thin and contracted. Presently a thunder shower rose up from the west, and passed directly over us; and soon another came, still heavier than the preceding. And now I was more impressed than ever with the peculiar motion of the Fall; not, however, because it experienced a change, but because it did not. The lightning gleamed, the thunder pealed, the rain fell in torrents; the storms were grand; but the Fall, if I may give its expression a language, did not heed them at all; the rapids above raged no more and no less than before, and the Fall poured on with the same quiet solemnity, with the same equitable intentness, undisturbed by the lightning and rain, and listening not to the loud thunder.

About half a mile below the Horseshoe Fall, a commodious road has lately been cut in a slanting direction, down the side of the perpendicular cliff, and through the solid rock, to the river. Here we find a regular ferry, and are conveyed in a small boat across the stream, which is now narrowed to a breadth of about twelve hundred feet, to the American side. The passage is perfectly safe, and, though short, delightful, as it affords a

superb view of the Falls above and the dark river below. The current is not very rapid, and near the American side actually sets up toward the Falls; by the help of which eddy the boat regains what it had lost in the middle of the stream. We land almost directly at the feet of the American Fall, and by walking a little way to the right, may place ourselves in its spray. Now look up, and the height will not disappoint you. Now attend to the voice of the cataract, and it will fill your soul with awe. It seems as if the 'waters which are above the firmament' were descending from the heights of heaven, and as if 'the fountains of the great deep were broken up' from below. The noise, which permits free conversation to those who are on the bank above, is here imperative and deafening. It resembles the perpetual rolling of near thunder, or the uninterrupted discharge of a battery of heavy ordnance, mingled with a strange crashing and breaking sound. This resemblance to the roar of artillery is heightened by the sight of the large bodies of spray which are continually and with immense force exploded from the abyss. The impression of superior height is gained, not so much from the fact that the American Fall is actually ten or twelve feet higher than the British, as from your having a complete *profile* view of the one, from brink to base, which you cannot well obtain of the other.

Flights of secure wooden steps bring us to the top of the bank,* where we again stand on a level with the descending Falls. We soon found that the greatest variety of interest was on this, the American side. The village of Manchester is situated on the rapid, just above the Fall. A bridge is thrown boldly over the rushing and 'arrowy' rapid to a small island, called Bath Island, where there are one or two dwellings and a paper-mill; and from this spot another bridge runs with equal boldness to Goat Island. The whole breadth of the space thus traversed is one thousand and seventy-two feet.

Goat Island is a paradise. I do not believe that there is a spot in the world, which, within the same space, comprises so much grandeur and beauty. It is but about a mile in cir-

* On this bank, near the ferry-house, there is a stone embedded in the ground, rudely carved on which there has lately been discovered, by removing the moss which had grown over it, the following inscription—'I. V. 1747.' This is by far the most ancient date to be found in the vicinity. I. V. whoever he was, when he looked upon the Falls must have been surrounded by a perfect wilderness. What poet will speak in his name, and describe his feelings, and record his thoughts, as he stood here alone with God?

cumference, and in that mile you have a forest of tall, old trees, many of them draperied with climbing and cleaving ivy; a rich variety of wild shrubs and plants; several views of the rapids; an opportunity to pass without discomfort under the smaller American Fall, and the very finest view, I will venture to say, of the great Crescent, or Horseshoe Fall. Turn to the left, as you enter this Eden, and you come out into a cleared and open spot, on which you discern a log hut, with vines round its door and windows, and a little garden in front of it, running down to the water's edge; a flock of sheep feeding quietly, or reposing pleasantly, under scattered clumps of graceful trees; while, beyond this scene of rural repose, you see the whole field of the rapids, bearing down in full force upon this point of their division, as if determined to sweep it away. Or, turn to the right, and threading the shady forest, step aside to the margin of the smaller American Fall,* and bathe your hands, if you please, in its just leaping waters. Then, pursuing the circuit of the island, descend a spiral flight of stairs, and treading cautiously along a narrow footpath, cut horizontally in the side of the cliff, enter the magnificent hall formed by the falling flood, the bank of which you have just left, and command your nerves for a few moments, that, standing as you do about midway in the descent of the Fall, you may look up, eighty feet, to its arched and crystal roof, and down, eighty feet, on its terrible, and misty, and resounding floor. You will never forget that sight and sound.

Retrace your steps to the upper bank, and then, if your strength holds out, proceed a short way further to the enjoyment of a view, already referred to, which excels every other in this place of many wonders. It is obtained from a bridge or platform, which has recently been thrown out over some rocks,† and is carried to the very brink of the Horseshoe Fall, and even projects beyond it; so that the spectator at the end of the platform, is actually suspended over it. And if he is alone, and gives way to his feelings, he must drop upon his knees, for the grandeur of the scene is overpowering. The soul is elevated, and at the same time subdued, as in an awful and heavenly presence. Deity is there. The brooding and

* This is separated from the greater Fall by a diminutive island, covered with trees, which tenaciously maintains its terrible position, in emulation, as it were, of Goat Island. This lesser Fall, small as it is compared with the others, would of itself be worth a journey.

† These are called the Terrapin Rocks.

commanding Spirit is there. 'The Lord is upon many waters.' The heights and the depths, the shadows and the sunlight, the foam, the mist, the rainbows, the gushing showers of diamonds, the beauty, and the power, and the majesty all around and beneath, environ the spirit with holiest influences, and without violence, compel it to adore. 'Deep calleth unto deep.' The cataract, from its mysterious depths, calleth with its thunder, back to the deep lake, and up to the deep sky, and forward to the deep ocean, and far inward to the deep of man's soul. And the answer of the lake, and the answer of the sky, and the answer of the ocean, are praise to the Maker, praise to him who sitteth above the water-flood, praise to Almighty God! And where is the soul which will not also hear that call, and answer it even with a clearer and louder answer, and cry, Praise to the Creator, praise to the infinite, and holy, and blessed God!

These Falls are not without their history;—but, like their depths, it is enveloped with clouds. Geologists suppose, and with good apparent reason, that time was when the Niagara fell over the abrupt bank at Queenstown, between six and seven miles below the place of the present Falls, and that it has, in the lapse of unknown and incalculable years, been wearing away the gulf in the intermediate distance, and toiling and travelling through the rock, back to its parent lake. The abrupt termination of the high bank and table land at Queenstown, the correspondence of the opposite cliffs to each other all the way up to the Falls, the masses of superincumbent limestone, which both the American and Canadian cataracts hurl, from time to time, into the boiling abyss,* all seem to favor this supposition. But when did the grand journey begin? When will it end? How vain to ask? How momentary human life appears, when we give our minds to such contemplations! Where was the cataract toiling in its way, when none but the awe-struck Indian came to bow before its sublimity? Where was it, when the moss-buried trunk, which now lies decaying by its borders, was a new sprung sapling, glittering with the spray-drops which fed its

* Within a few years, several pieces of the upper stratum have been thus thrown down. The waters, however, are now obliged to act upon a surface three times wider than that which formerly sustained them, and the limestone is becoming more and more compacted with the harder chert, as they approach Black Rock. Their retrocession must therefore be slow, beyond the power of computation. Beneath the limestone strata, there is a layer of loose shale, which is easily washed away, and which is always first hollowed out, before the limestone falls.

infant leaves? Where was it, before the form of a single red man glided through the forest? Where was it, when lofty trees stood by it in the intimate sympathy of centuries, which long since have been resolved into earth? Where was it, when winds and clouds were its only visitors; and when the sun and blue heaven by day, and the moon and stars by night, alone looked down and beheld it, the same as they do now? And is not science blind and foolish, when she does not learn to be humble? Is she not miserably blind and foolish, when, being in her elements and leading-strings, she lisps impiety, instead of prayer!

Four days flew by us, like the waters of the rapids, while we staid here, and then came our time for departure. As we rode down to Lake Ontario, on the bank of the river, and turned every moment to catch glimpses of the Falls, we were favored, when between two and three miles on our way, with a full view of the whole cataract, through an opening in the woods. We stopped and alighted, in order to enjoy the melancholy pleasure of contemplating it for the last time. It looked softer and gentler in the distance, and its sound came to the ear like a murmur. I had learned to regard it as a friend; and, as I stood, I bade it, in my heart, farewell.

Farewell, beautiful, holy creation of God! Flow on, in the garment of glory which he has given thee, and fill other souls, as thou hast mine, with wonder and praise. Often will my spirit be with thee, waking and in dreams. But soon I shall pass away, and thou wilt remain. Flow on, then, for others' eyes, when mine are closed, and for others' hearts, when mine is cold. Still call to the deeps of many generations. Still utter the instructions of the Creator to wayfaring spirits, till thou hast fulfilled thy work, and they have all returned, like wearied travellers, to their home.—*Token,* 1832.

ORNITHOLOGY.

NO. I.

[Under the above-named head we propose to publish a series of essays on the general structure and habits of birds, from the most authentic sources.]

THE term Ornithology is derived from the Greek *ornis*, a bird, and *logos*, discourse, and donotes that part of Zoology which treats of birds.

Birds are two-footed animals, covered with feathers, and furnished with wings. Like quadrupeds and the cetaceous tribe, they have warm blood, a heart with two ventricles, and two auricles, and lungs for the purpose of respiration; but they are distinguished from both by their feet, feathers, wings and horny bill, as well as by the circumstances of their females being oviparous.

The elegant and beautiful coloring of many of the feathered race, the graceful ease of their flight, their various music, their tender solicitude for their offspring, their engaging instincts, their susceptibility of domestication, and their subservience to the sustenance of man, have, in all ages, contributed to interest the latter in the study of their history.

The structure of birds and their habits of life, are wonderfully adapted to the various functions which they are destined to perform. The pointed beak, the long and pliant neck, the gently swelling shoulder, the expansive wings, the tapering tail, the light and bony feet, are all wisely calculated to assist and accelerate their motion through the yielding air. Every part of their frame is formed for lightness and buoyancy their bodies are covered with a soft and delicate plumage, so disposed as to protect them from the intense cold of the atmosphere through which they pass; their wings are made of the lightest materials, and yet the force with which they strike the air is so great, as to impel their bodies forward with astonishing rapidity, while the tail serves as a rudder to direct them to the different objects of their pursuit. The internal structure of birds is no less wisely adapted to the same purposes. Their lungs have several openings, communicating with corresponding air bags, or cells, which fill the whole cavity of the body from the neck downwards, and into which the air passes and re-passes, in the process of breathing. This is not all; the very bones of birds are hollowed out with the design of receiving air from the lungs, from which air pipes are conveyed to the most solid parts of the body, and even into the quills and plumelets of the feathers, which are hollow or spongy for its reception. As all these hollow parts, as well as the cells, are only open on the side communicating with the lungs, the bird requires only to take in a full breath to fill and distend its whole body with air, which, in consequence of the considerable heat of its body, is rendered much lighter than the air of the atmosphere. By forcing this air out of the body again, the weight becomes so much increased, that birds of a large size can dart down from great heights in the

air with astonishing rapidity.* The structure of insects is not a little analogous.

The almost universal diffusion of air in the bodies of birds is of infinite use to them, not only in these long and laborious flights, but likewise in preventing their respiration from being stopped or interrupted by the rapidity of their motion through a resisting medium. Were it possible for man to move with the swiftness of a swallow, the actual resistance of the air, as he is not provided with internal reservoirs similar to those of birds, would soon suffocate him.

Stomach of Birds. The stomach of birds forms them into two distinct natural classes; those with cartilaginous stomachs, covered with very strong muscles, called a gizzard; and those with membranous stomachs more resembling that of carnivorous quadrupeds. The former is given to birds whose principal food is grain and seeds of various kinds, or other hard substances that require much friction to communicate, to assist which, gravel is necessary; the latter is given to birds which feed upon flesh or fish, and whose digestion is accelerated more by the gastric juice than by the action of the stomach. Those of the first class digest or retain every substance swallowed; and those which eject or disgorge innutritious matter unavoidably taken in, such as feathers, fur, bones, &c. belong to the second class, as is conspicuous in the falcon, owl and others that feed on fish. Granivorous birds seem to possess the power of retaining the small stones taken into the gizzard, or evacuating them, when they become polished and less useful, but cannot disgorge them. In a state of nature the quantity of gravel taken in must be regulated, no doubt, by the sensation of the stomach; but, wonderful as it may seem, in domesticated animals those instinctive faculties are deranged. Instances frequently occur where the whole cavity of the gizzard is filled with gravel stones. The food of granivorous birds is conveyed entire into the first stomach, or craw, where it undergoes a partial dilution by a liquor secreted from the glands, and spread over its surface. It is then received into another species of

* Humboldt saw the enormous vulture of the Andes, the majestic condor, dart suddenly from the bottom of the deepest valleys to a considerable height above the summits of Chimboraco, where the barometer must have been lower than ten inches. He frequently observed it soaring at an elevation six times higher than that of the clouds in our atmosphere. This bird, which reaches the measure of fourteen feet with the wings extended, habitually prefers an elevation at which the mercury of the barometer sinks to about sixteen inches.

stomach, where it is farther diluted, after which it is transmitted into the gizzard, or true stomach, consisting of two very strong muscles, externally covered with a tendinous substance, and lined with a thick membrane of prodigious power and strength, in which organ the food is completely triturated, and prepared for the operation of the gastric juices. In order to ascertain the strength of these stomachs, Spallanzani had recourse to a great variety of ingenious experiments. Tin tubes full of grain were forced into the stomachs of turkeys, and after remaining 20 hours, were found to be broken, compressed and distorted in the most irregular manner. In the space of 24 hours, the stomach of a cock broke off the angles of a piece of rough, jagged glass, though, on examining the gizzard no wound or laceration appeared. In a ball of lead were fixed 12 strong needles, with the points projecting about one-fourth of an inch from the surface. Thus armed, the ball was covered with a case of paper, and forced down the throat of a turkey. The bird retained it a day and a half without manifesting any symptoms of uneasiness, and the points of all the needles were broken off close to the surface of the ball, except two or three, of which the stumps projected a little. The same interesting observer relates, that he fixed 12 small and very sharp lancets, in a similar ball of lead, which was given in the same manner to a turkey cock, and left eight hours in the stomach, at the expiration of which the organ was opened; but nothing appeared except the naked ball, the lancets having been broken to pieces, and the stomach remaining sound and entire. Hence we may infer, the stones so often found in the stomachs of many of the feathered tribes, may powerfully contribute to the pulverization of grain and other hard substances which constitute their food.

Granivorous birds partake much of the nature and disposition of herbivorous quadrupeds, agreeing with them in the number of their stomachs, the quality of their food and the gentleness of their manners. Content with the seeds of plants, with fruits, insects and worms, their principal attention is directed to procuring food, hatching and rearing their offspring, and eluding the snares of men and the attacks of predaceous animals. As they are generally tractable and easily domesticated, man has selected for his own advantage those which are most prolific and profitable, which form a valuable store of rich, wholesome and nutritious food. The stomachs of carnivorous birds are smaller than those of the granivorous kinds, and their intestines are much shorter. Many species of birds possess a reservoir for food, called a

craw or crop, which seems to answer the same purpose as the first stomach of ruminating animals. Here it is that the food is softened and prepared for the stomach, or carried to the young.

Blood of Birds. This appears to be more highly oxygenated than in other warm-blooded animals; at least it is warmer, of a brighter color, and circulates more rapidly, the pulse of birds usually running above a hundred beats in a minute. This may account for their being so voracious; some birds consume more than their own weight of food in the course of a day.

CABINET CYCLOPÆDIA.

[We have just received from London the twenty-second volume of the Cabinet Cyclopædia, containing a 'Treatise on the Origin and Progressive Improvement of the Silk Manufacture: conducted by Rev. Dionisius Lardner, L.L. D. F. R. S. L. & E. etc.

This work is eminently calculated to furnish the Silk Cultivator with most of the necessary information to accomplish his art, and it cannot fail to be instructive and interesting to the general community.

We propose to publish a considerable portion of it, in a series of essays, with notes and observations from practical and scientific men of the United States. We shall, however, omit extracting from it in the present number, to give place for some preliminary remarks on the subject.]

SILK MANUFACTURE.

NO. I.

Within these few years past, the public attention has been directed more than ever before, to the culture of silk.—Some zealous efforts have been made, and are still making to increase and disseminate this branch of business throughout the Union. The public sentiment begins to demand that we should no longer be indebted to other countries for an article that can be so easily produced in our own; and that the natural riches of our country, embracing every variety of clime and soil, should remain subject to the bias of contracted vision, and dormant beneath the eye of prejudice. Too long, indeed, have Americans listened to the counsel of strangers to their country and to its interests, rather than seek for facts, in the bosom of her grateful soil—thereby allowing their own reason and intelligence to the dupe of foreign ignorance, envy and rivalry. But happily for ourselves, we live in an age and country in which the people are but little prone to credit

such exclusive possession of nature's gifts; and it will create exceeding disappointment in all unprejudiced minds, if the lapse of a few short years shall not place the affected superiority of other countries among the fictions and delusions of former ages. Bountiful nature, replete with benevolence, has bestowed on us every favor within her gift, and asks only of man to aid the developement of her intrinsic riches by the hand of culture*. As to the assertions, advanced by foreigners, that our climate is not congenial to the culture of silk, or that it cannot be manufactured in this country, they certainly cannot be supported by facts, and have principally obtained currency and credence by repetition. For, experiments sufficiently numerous have been made to establish the fact, that the culture and manufacture of this article can be carried on with as much or more advantage in this country as it can be in Europe. And there need no longer remain a doubt that it will become one of the most important branches of our national industry, and like that of cotton, combine in its favor the triple interests of agriculture, manufactures and commerce.

To show the importance of this species of culture in the United States, and the profit attending it, permit me to make a few brief statements. It appears by the report made to Congress by their Committee on Agriculture, in May, 1826, that in 1821 the importations of manufactured silks into the United States amounted to $4,486,924; of which $1,057,233 were exported; and by a gradual increase in the course of four years, the importation amounted to $10,271,527; of which only $2,565,742 were exported, leaving a balance of $7,705-785 to be paid for. Since that time, it has gradually increased, and the consumption of the past year may be fairly estimated at $10,000,000; being about one dollar to each free white person including men, women and children.

Fortunately for the United States, the nations that supply us with manufactured silks are as much in want of the raw article, as their customers of their fabrics. France imports annually, to the amount of 30,000,000 of franks, of raw silks; and Great Britain purchases annually to the amount of £1,800,000 sterling. These two sums exceed 14,000,000 of American dollars.

Here then are two rich and increasing markets offered to the industry of the American people for the sale of their raw silk. They must expect to meet competition with other na-

* Prince on the Vine.

tions; but the superiority of the American silk will insure them a preference.

The following statistics of a mulberry orchard of two acres, are by the late Andrew Parmentier, Esq. of New York:—

650 standard trees in the low parts of the ground, each 20 feet apart.
250 standard trees on the rising places, 12 feet apart.
650 dwarf trees on suitable ground.

1550 total.

This ground to be fenced by mulberry hedges. The purchase money for about two acres, with cost of manure and necessary tillage, is estimated at $500.

Supposing that to secure full success to this orchard by using none of the foliage, and tilling and replacing dead trees during five years, counting loss of interest and other expenses accruing, we have an increase of debt of $375, and a capital of $881; but commencing from the fifth year up to the twentieth of its existence, the author of these statistics forms three different periods of five years each. The plantation will give in the first period from 90 to 95 quintals of foliage, that is 9000 lbs. or fodder for five ounces of worm seeds; 35 lbs. of silk worth about $180, that is 20 per cent. on $881. The second period will annually afford for 14 ounces, 15,000 quintals, or 95 lbs. of silk, equal to 47 per cent. on $881. But the third period to the twentieth year of age of the orchard, from 500 to 650 quintals may be expected, which will feed 28 ounces, and give 196 lbs. of silk, worth nearly $1000, or more than 112 per cent.

Admitting however that each crop of silk costs some expense, which in no way whatever could be one-quarter or one-third the profits, these latter are so secured and so considerable, that the undertaking would prove in the highest degree useful and profitable.

The following estimate is by Mr. D'Homergue, a celebrated silk manufacturer of Philadelphia.

An acre contains 43,560 square feet. 1500 mulberry trees, six years old, will produce each 30 lbs. of leaves, which make 45,000 lbs. An acre will contain 1500 mulberry trees, planted at a distance of 12 square feet from each other. This is in case it is wished to grow corn or wheat in the intervals between the trees. But if the ground is to be devoted to mulberry trees alone, 3000 trees may be planted on an acre at six square feet distance, and these at six years old will produce 90,000 lbs. of leaves. Selling the leaves at half a cent a pound, the purchaser gathering them, or at one cent a pound

delivered to the purchaser, would produce in the first case $900, in the latter $450.

According to the calculation of Dandolo, an Italian silk cultivator, which appears to be exaggerated, 90,000 lbs. of leaves, at 21 lbs. of leaves for one pound of cocoons, would produce at least 3700 lbs. of cocoons, which at 25 cts. a pound (the moth not being stifled) would produce $950. After killing the chrysalides, the cocoons will produce a higher price, say, 30, 40, or perhaps 50 cents a pound, according to the quality and abundance, or scarcity of the articles, and the profit will be proportionate.

The said 3700 lbs. of cocoons, being good and well-reeled, will produce, at eight pounds of cocoons for one pound of silk, 420 lbs. of the raw article, which at $3 a pound, the price which China silk sells for in our sea ports, will amount to $1260; and if perfectly well-reeled and suited to the European market, will produce, at $6 a pound, $2520, the amount of the produce of one acre of land the sixth year after planting! Now allowing one-third part of this sum for rearing the worms and reeling the silk, the principal part of which may be performed by women and children, a net profit of $1680 per acre may be realized; and after that time, as the trees grow larger, a much greater amount.

ON THE ACCLIMATING PRINCIPLE OF PLANTS.

[From the American Journal of Geology.]

It is nature's plan, that nothing should remain fixed and stationary. She exists by motion, and manifests herself through endless changes: even death and decomposition are her pioneers, to prepare the way for life and existence. The very rocks and minerals, (unorganized matter,) are changed by the action of the elements, form new affinities, and yield to the circumstances of moisture and heat, with which they may be surrounded. Animals exhibit still more changes; they possess powers of development, and the means of continuation of kind. Endowed with locomotion, they can change their climate and habitation: with a natural pliancy of constitution, they can accommodate themselves to the quality of their food, and character of the country upon which they may be thrown, and appear beautiful or deformed accordingly as they may be acted on by circumstances. Many of them can bear the most vio-

lent contrasts of heat and cold, and adapt themselves to many climates.

Vegetables too, are organized, have their growth and decay, and the powers of re-production. Beyond this we allow them but few capacities; no locomotive powers, none of the sensibilities common to animals, nor that pliancy which can accommodate itself to circumstances. They are the fixtures of nature, with but little latitude in which to flourish, and but little diversity of soil from which to derive nutriment. The object of this paper is to enlarge their sphere, and to show that they possess more power to change their climates, and capacity to bear the contrasts of heat and cold, than we have generally ascribed to them; to illustrate it with many instances where they have actually adapted their growth and habits to a great extent of country and diversity of latitude, and to urge agriculturists to make more efforts to vary their culture.

Plants have *directly* no locomotive powers, but *indirectly* they have in a great degree the faculty of changing their places, and, consequently, their climate. The embryo germ wrapped in a kernel, or seed, is virtually a plant, ready to germinate when thrown upon its parent earth, and affected with heat and moisture. It is in a most portable shape, and can be transported with ease to an unlimited distance. Nature in many instances superadds to seeds, wings, down, feathers and chaff, by which they become buoyant, and are carried by the winds of heaven, by the storms that sweep the forest, and by the streams and currents of rivers and the ocean, to an immense distance, and through many degrees of latitude! They become finally deposited in some genial soil, and at one remove, or through a succession, they occupy extensive regions. Nature manifests her great care of the embryo, by coating some of her seeds with shells, which protect them from the attacks of insects and the action of the elements; others have bitter, narcotic or poisonous qualities, which forbid animals eating them; and many are filled with oily, or resinous matter, which resists for ages, and even centuries, the action of the elements, unless acted upon by the proper degree of heat and moisture. By such qualities they endure, and await a suitable time and conveyance to their destined place, in order to extend and vary their families.

Birds also convey the seeds of plants in their crops over a wide extent, before they become triturated and digested; and when these winged carriers die, or decay, from accident or age, the seeds are deposited, and take root in some distant land. Animals also convey them in their stomachs to a con-

siderable distance, and pass them uninjured by the powers of digestion.

Man, more provident than all, to whom plants are necessary whose support, whose comforts, and whose pleasures connect him with them, carries their choice seeds, slips and scions far and wide. His interests foster their growth, his attentions enrich their products, and his skill and science preserve their existence, and adapt them to their new condition. In an improved community man's wants multiply: he has occasion for the more varied and rich fruits; more abundant and luxurious clothing, and furniture of vegetable growth; odors to regale his senses, vegetable flavors to pamper his appetites, and all the medicinal plants to heal his various diseases, and invigorate his shattered constitution. He attaches himself to agriculture and horticulture; plants becomes his companions; he carries a creative resource into those departments, and by his attentions, forms new varieties and excellencies, unknown to the wild state of vegetable existence. Such are the means nature has provided for the propagation and extension of plants; such are the indirect locomotive powers they possess. We must no longer, therefore, consider vegetables such inert and sluggish beings.

We will now treat plants as having a kind of locomotive existence. We know that they are very perfectly organized, have sensibility and sexual intercourse. We know that they have lungs, by which they breathe, and are connected with the air. We know by abundant experience, how easily they are affected by the elements, by heat and cold, moisture and drought. We know how radically soil affects their productiveness, how immediately they are stinted or stimulated by the nature of the extraneous circumstances with which they are surrounded. Beings, therefore, that have such perfect organization, that, although they are fixed in their places, are deeply changed by every shower, and every breeze, and every stroke of the cultivator—beings, so necessary to the wants, and very existence of animated nature—should possess, in a high degree, the faculty of changing their climate, and of accommodating themselves to circumstances, and the strong contrasts of seasons. Nature else would be wanting in her usual foresight, and in her adaptation of one thing to another.

If an animal is carried by accident, or its own wanderings, to a country or climate that is not congenial to its nature, it can and does make use of its locomotive powers, to regain one that is more suitable to it. This happens every day. Thousands of birds and fish, and other animals, migrate regularly, to

avoid even the different seasons of the same year, and could not, with all their versatility of constitution, exist without it. We may infer, then, that plants, which, after having rooted themselves, cannot migrate at all, should be endowed with faculties to bear all the changes of the seasons, and even of climate, in the same dull place of their existence. *They are so endowed*, and can often bear more changes, and support more disasters of storms and ravages of insects, than animals; and often continue to flourish under violent and sudden changes.

Human care, and the providencies of nature, have given to many plants a great extent of climate and latitude, an enlarged growth, and an increased and improved product. Let us bring together such instances as are within the knowledge of all, and which ought to stimulate our cultivators to greater efforts.

The valley of the Euphrates was doubtless the native region of all those fine and delicious fruits which enrich our orchards, and enter so largely into the luxury of living. We thence derived all the succulent and nutritious vegetables that go so far to support life; and even the farinaceous grains appertain to the same region. The cereal productions began in that same valley to be the staff of life.

Our corn, our fruit, our vegetables, our roots, and oil have all travelled with men from Mesopotamia up to latitude 60°, and even farther, in favorable situations. The cares of man have made up for the want of climate, and his cultivation atoned for this alienation from their native spot. The Scandinavians of Europe, the Canadians of North America, and the Samoides of Asia, are now enjoying plants which care and cultivation have naturalized in their bleak climes. Melons and peaches, with many of the more tender plants and fruits, once almost tropical, have reached the 45° of latitude in perfection, and are found even in 50°. Rice has travelled from the tropics to 36°, and that of N. Carolina now promises to be better than that of more southern countries. The grape has reached 50°, and produces good wine and fruit in Hungary and Germany. The orange, lemon and sugar cane, strictly tropical, grow well in Florida, and up to 31½°, in Louisiana, and the fruit of the former much larger and better than under the equator.

Annual plants grown for roots, and vegetables, and grain, go still farther north in proportion, than the trees and shrubs, because their whole growth is matured in one summer; and we know that the developement of vegetation is much quicker

when spring does open in countries far to the north, than in the tropics. In Lapland and on Hudson's Bay, the full leaf is unfolded in one or two weeks, when spring begins, although it requires six or eight weeks in the south. Nature makes up in despatch for the want of length in her seasons, and this enables us to cultivate the annual plants very far to the north, in full perfection. The beans, pumpkins, potatoes, peas, cabbages, lettuce, celery, beets, turnips, and thousands of others, seem to disregard climate, and grow in any region or latitude where man plants and cherishes them. The fig is becoming common in France; the banana, pine-apple, and many other plants, have crossed the line of the tropics, and thousands of the plants, valuable for food, clothing and medicine, and such as are cultivated for their beauty, fragrance or timber, are extending their climates, and promise much comfort and resource to man. Plants lately introduced, whose cultivation has not run through many ages or years, have acquired but little latitude in their growth, and show but little capacity to bear various climates, because time has not yet habituated them to such changes, and human cares have not imparted to them new habits and new powers.

Nothing can be effected by suddenness in *acclimating* plants; too quick a transition would shock them; it must be a very gradual process, embracing many years, and many removals. The complete success that has attended the plants first named, the earliest companions of man, proves this. In the more recent plants success is exactly in proportion to the length of time that a plant has been in a train of experimental culture.

The most striking method of testing the effect of climate on plants, is to carry suddenly back to the south, such as have been extended far, and become habituated to a northern climate. Such plants have so much vigor, and the habit of a quick and rapid growth so firmly fixed on them, by a long residence in the north, that when suddenly taken to the south, although the season be long and ample, they continue, from habit, to grow and mature quick, and obtain the name of rare-ripe; because they do not take half of the time to mature, that those of the same family require, which have never been so changed. Gardeners give us early corn, peas, fruit, and turnips, by getting seed from places far to the north; and cotton growers renew the vigor of the plant by getting the most northern seed. This practice is common in the case of most plants, and is founded on the supposition that plants do, and can acquire habits.

The fact supported in the first number of the American Journal of Geology and Natural Science, 'that plants are most productive near the northern limit in which they will grow,' that they bear more seed or fruit, and have more vigor of constitution, offers much encouragement to agriculturists. This proves that it is not a meagre, stinted existence, devoid of profit or productiveness, that we give to plants, by pushing their culture far north, but a strong and healthful growth, one that repays the labor and attention, by a greater product than belongs to more southern situations.

Every view that we can take of this interesting subject, every fact within our knowledge, whether drawn from the actual state of cultivation, or from physiological investigations into the habits, nature and construction of plants, goes to show that plants do become acclimated, both in the natural and artificial way, to a great extent. Enough has been witnessed to prove that plants have a physical conformation, that does accommadate itself to circumstances, and have capacities more extensive than are generally ascribed to them: enough has been realized to encourage farther efforts, and to give us hopes of much future benefit.

In this enlightened age, where invention in the arts and mechanical philosophy is changing the whole order of our social economy, where new comforts and resources, unknown to our fathers, are daily developed, and, as it were, created; in this age, where labor-saving machinery is redoubling the productions of the arts, almost exempting man from in-door exertion, and cheapening all the elegancies of clothing, furniture, buildings and books, until luxuries are common to rich and poor, and education within the reach of all, why should not agriculture awaken, put forth its energies, and partake of that spirit of improvement that is working its magic in all other departments? Why does it not avail itself of that knowledge of the nature of the soil, which chemistry gives? those tabular statements of the weather and climates, which naturalists furnish? those philosophical investigations into the nature and habits of plants, which have been presented? and that labor-saving spirit that seems to know no limits in other branches of business? Why should all our capital improvements fly the open fields, where culture exists, and be realized only in cabinets and manufactories? Agriculture follows the old dull routine, and its products lumber on to market in heavy carts, while all other branches move on, aided by a thousand inventions, with ease and despatch. That field, whence our food is derived, and on which our very existence

depends, lies neglected, while we cultivate luxuries to a morbid excess. Every thing is cheapened but human food; every thing becomes annually more attainable, but the necessaries of the table. If this disproportion between the arts and agriculture continues to advance, we are destined to live in a sort of splendid pauperism: enjoying the luxuries of fine houses and furniture, we shall enjoy every thing to satiety but bread. W.

THE DOMESTIC CAT DIVING FOR FISHES.

[From Loudon's Magazine of Natural History.]

Sir—In reading that delightful little work of Mr. White's, 'The Natural History of Shelborne,' the propensity of cats for fish, and their repugnance to wetting their feet, are remarked by the intelligent author. An anecdote or two of these beautiful but maligned quadrupeds, proving their piscivorous natures in the one case, and in the other a strong natural antipathy overcome by a still more powerful propensity, will perhaps be amusing to some of your readers, who, like myself, have a regard for every thing 'which lives, and moves, and has a being.' In the centre of my father's garden was a fish-pond, stocked with various kinds of fish. Many a time and oft have I witnessed puss (and a very pretty tortoise-shell puss she was, and a great favorite withal) watching at its brink for its finny inmates, and on their appearing at the surface darting on her prey, and in spite of the wetting and ducking she encountered, bringing them in triumph to the pond's edge, and regaling on the delicious fare. This sport, I believe, she continued in the enjoyment of till the day of her death; and so amused were we with her angling powers, that no obstruction was ever thrown in her way. The pond, moreover, was not, as some may imagine, sloping in its bottom, and picturesque in its appearance, but it was completely a cockney pond in its *tout ensemble*, octangular in its shape, of precise equality in its depth, with a pavement smooth and regular both in the sides and base; therefore, before this puss could gratify her taste, a plunge was to be taken which was sufficient to make the stoutest cat's heart tremble.

The other anecdote relates to a cat of more extraordinary acquirements, which belonged to one of my workmen. In a large and deep pond at my premises in the Green Lanes, a stock—not of fish, but of rats—had accumulated, the de-

struction of which was undertaken by this uncommon cat. He was daily in the habit, for nine or ten years, of stationing himself on the margin of the water, and of jumping into the liquid element on the appearance of his game. A day seldom closed unsuccessfully, and he has been seen and known to catch and bring from the watery deep four of these vile vermin betwixt sunrise and sunset. As I said, this amusement was kept up by him for the space of nine or ten years, in fact until his rat-catching powers deserted him; and when his teeth became all extracted in the performance of his daily feats, and his master had him killed, that the miserable death of starvation might not await him. This cat was truly a sportsman, and pursued the sport solely for the love of it; he caught his game with avidity, but never eat a morsel; so that the pleasure of the chase alone had charms enough in his mind to vanquish one of the strongest antipathies of his nature.

I am Sir, &c.

WILLIAM SCALES.

Stamford Hill, April 13, 1831.

MANUAL ON THE CULTURE OF SILK.

[A Manual containing Information respecting the growth of the Mulberry Tree, with suitable Directions for the Culture of Silk. In three parts. By J. H. Cobb, A. M. Published by Direction of His Excellency Gov. Lincoln, agreeably to a Resolve of the Commonwealth. Boston: Carter & Hendee, 1831.]

We have perused this treatise with much pleasure, and think it will be of great utility to those who are engaged in the culture of silk. It is introduced by an able report of a committee of the Massachusetts Legislature, of which Mr. Abel Wheeler was chairman, and a resolve 'That his Excellency the Governor be requested to cause to be compiled and printed a concise Manual, to contain the best information respecting the growth of the Mulberry Tree, with suitable directions for the culture of Silk—and that this manual be distributed in suitable numbers in the city of Boston, and to every town in the Commonwealth. That to defray the expense thus incurred, he be authorized to draw his warrant on the treasury for a sum not exceeding six hundred dollars.'

The author says in his preface, that 'In preparing this Manual the author has been guided by the personal experience which he has had for several years in the culture of the

mulberry tree, and rearing of silk worms in the state of Massachusetts.'

The work is accompanied with recommendations from Mr. P. S. Du Ponceau of Philadelphia, and Dr. Felix Pascalis of New York, both of whom are well informed in the silk culture. They speak in high terms of the ability of the author, and the just execution of the work, and conclude that it deserves the confidence of the public, and that its circulation should be encouraged.

BUFFON'S NATURAL HISTORY.

[A Natural History of the Globe, of Man, of Beasts, Birds, Fishes, Reptiles, Insects and Plants. From the Writings of Buffon, Cuvier, Lacepede, and other eminent Naturalists. Edited by John Wright, Member of the Zoological Society of London. A New Edition, with Improvements from Godfrey, Griffith, Richardson, Lewis and Clark, Long, Wilson and others. With Five Hundred Engravings. In Five Volumes. Boston: Gray and Bowen, 1831.]

We have been favored with a copy of this work, and have been highly interested with its perusal. From its being nearly destitute of technicalities it is well adapted to popular reading. We believe that there is not so much valuable matter presented to the public at so cheap a rate, as is contained in this work. It abounds with descriptions and interesting anecdotes of a great portion of the Natural World, which renders it worthy the attention of the enlightened public. The American editor in his preface observes, that 'The English edition of this work appeared under the title of "Buffon's Natural History, &c." On examination, it seemed hardly to deserve this title, as it consisted rather of selections from Buffon's works, with additions from Lacepede, Cuvier, and other eminent naturalists. We have therefore given it a title which seems to correspond more exactly with its character.

'It will be at once apparent that the work was not designed for the scientific, but only for the general reader. The English editor appears to have had it in view, to collect from Buffon and others, the most accurate and lively descriptions of the various objects which belong to the animal kingdom, for the purpose of forming a *popular* treatise on Natural History; he therefore avoided the use of scientific terms, and arranged the subjects with little regard to scientific classification.

'If there were defects in this plan, still the design, on the whole, appeared to be important, and we have undertaken to present a new edition of the work to the American public, keeping in view the original plan of the London editor; we have not materially altered the arrangement of the work; but we have collected, from various sources, a large amount of materials, and added about three hundred pages of matter. This chiefly relates to American Zoology, which was very imperfectly treated of in the London edition. We have made free use of the excellent work of Dr. Richardson, recently published in London, and have been therefore able to furnish a tolerable complete account of the Quadrupeds of North America; we have also selected from Wilson many of his inimitable descriptions of our own birds, and believe that we have noticed most of the species in his work, as well as that of M. Bonaparte. We have not only given all the best engravings in the London edition, but we have added many others, from the Zoological Gardens, Tower Menagerie, and other sources; a few have been drawn from living animals.'

We shall make a brief extract which may not be uninteresting to our readers. In speaking of the *lusus naturæ* of the human species, the following description of the Siamese youths is given:

'They were born in the east, and are known as the Siamese youths. A fleshy band, of from four to six inches long, and two broad, proceeding from the pit of each stomach, connects them together. The entire band admits four fingers to pass freely behind it, when the boys stand shoulder to shoulder, and its width and thickness allow the thumb to meet the fingers on the front aspect. The vestiges of one common navel are visible at the lower and middle part of the band, and it is equidistant between the two bodies. The band is hollow, except about an inch in the centre, and there is evidently a hernial protrusion into it from each of the boys, in the act of coughing. Their appearance is healthy, their dispositions cheerful, and their attitudes and motions graceful. They move across the room with all the ease and grace of a couple skilfully waltzing, and seem never to have any difference of intention or purpose which can give pain to their band of union by making them draw different ways. The natural position of the youths, or that which seems to place the connecting ligament in its natural form, is that of face to face. This position, as must be obvious, is extremely inconvenient, and the boys have consequently accustomed themselves to stand or move side by side. Their persons are thus

drawn mutually closer, which makes it necessary for one to place his arm about the neck or waist of the other. The position may be varied—that is, the ligament may be made an axis, upon which the youths can turn and bring in contact the two opposite sides, instead of those which were first in collision. Their identity of purpose, and unity of movement, combined with a general similarity of tastes, disposition and habit, had created in some a suspicion that their organization was more intimately connected than at first sight appears. They eat, drink and sleep simultaneously; their health is affected alike; and, on being conveyed through the streets in a coach, so perfect is their unity of *action*, that they could not be prevailed upon to look out of its opposite windows. These circumstances many have been disposed to attribute to something more than the power of habit; but there can be no doubt that the youths are perfectly distinct beings, having each his organization totally independent of each other. This is placed beyond a doubt by various circumstances. No one can fail to be touched with the perfect harmony that subsists between them. Attempts have been made to create jealousies between them, but without the slightest effect. Any gift which they receive, capable of division, is shared between them; and any other description of present passes from one to the other as a joint possession. It would perhaps be more just to say, that they recognize no difference between themselves. A very attentive observer, however, will not fail to discover between these two boys, who certainly bear the strongest possible resemblance to each other, a marked distinction. One seems to be a little more robust than the other, and even to possess an intellectual superiority over his brother. Perhaps this notion acquires plausibility from the circumstance that the former generally acts as the organ of communication on the joint part with the interpreters. It is observed, that this superior brother yields on all occasions to the impulses of the weaker, giving up his own choice, and preferring the course intimated by the other. The inferior brother then playfully leans against his mate for support, or the one pats the cheek, or presses the forehead, or adjusts the shirt collar of the other, in such a way as betrays the kindliest feelings in each, and the tenderest affection for each other.'

We may hereafter make other extracts from this work of equal interest with the preceding.

MISCELLANEOUS INTELLIGENCE.

Boston Society of Natural History.

This Society was instituted for the purpose of contributing to the advancement of Natural Science, with the view of forming a Cabinet of Natural History, and of holding meetings, for lectures, and to discuss subjects relative to the science.

The number of members is unlimited. Every friend of science, at whatever distance he may be from the place where the Society is established, may become a member, and enjoy the benefits of the Society, by being nominated by a member of the Society, and afterwards chosen with a majority of three-fourths of the members present, and by paying an annual assessment of three dollars, exclusive of paying an initiatory fee of five dollars.

A meeting is held in the afternoon of the first Wednesday of each month, for the purpose of mutual improvement, and for transacting the general business of the Society, and lectures are given annually by members of the Society, on the various branches of Natural History.

At the commencement of the Society in February, 1830, several friends of science met for the purpose of seeing what measures could be taken for the formation of such an association, and a committee was chosen to report on the subject at an adjourned meeting. The committee having reported favorably, the Society was immediately organized under the name of the Boston Society of Natural History.

In the October following, a course of lectures was commenced and pursued through the winter, with uncommon interest. A committee being chosen to procure an act of corporation, it was carried before the Massachusetts Legislature, and incorporated Feb. 25, 1831. Since that time the Society has held regular meetings, at which time many interesting communications have been read and several valuable donations received.

Measures were adopted early last season to prepare for the lectures of the present course, which commenced in November. Five able lectures have been given and listened to with much satisfaction.

The Society, at the present time, consists of 112 members, several of whom are our most learned and distinguished men. An ardent zeal has been manifested from the commencement by its members, and we are justified in concluding that much good will result from their untiring efforts for the advancement of science.

Effects of Fear.

The Courier des Etats Unis gives the following account of an experiment said to have been recently made at St. Petersburg: 'Six condemned criminals were placed in an hospital, and confined in the same rooms which had been occupied by sufferers from the cholera. This fact was unknown to them, and they remained in good health for three weeks, making use all the while of the beds which had been used by those who died of that disease. Their sentence of death was then announced to them, with a promise of pardon, if they would enter an hospital, which had been used for the cholera patients, and should escape the malady. They asked nothing better, and were conducted to a place where the cholera had never been. In a few days they were attacked from fear by the cholera. Four of them died—only two survived.'

Live Oak.

It appears by a letter of Col. White of Florida, addressed to the committee on Naval Affairs, that each acre of land adapted to the cultivation of the live oak will bear twenty trees, which, in fifty years from the time of planting, would be fit for ship-building; and worth ninety dollars each; and that the expense of superintendence during the whole period of their growth, for a plantation of 6000 acres, would not exceed $100,000. Little progress has been made in promoting the cultivation of this timber on the lots which have already been purchased; nor have we seen any indication that any measures of importance have been taken for this purpose by the present secretary of the navy.—*Advertiser.*

Method of preventing Iron and Steel from Rusting.

This easy method consists in heating the steel or iron until it burns the hand; then rub it with virgin or pure white wax. Warm it a second time so as to melt and divide off the wax, and rub it with a piece of cloth or leather until it shines well. This simple operation, by filling all the pores of the metal, defends it completely from rust, even though it should be exposed to moisture.—*Jour. de Connois. Usuelles.*

Poisoning by Mouldy Bread.

Dr. Westerhoff attended, in 1826, upon two children of a laborer, who had been simultaneously attacked with the following symptoms. The eldest, ten years of age, had his face red and swollen, his countenance was animated and bewildered, tongue dry, pulse feeble and quickened, head ache, giddiness, unextinguishable thirst, violent cholic, desire to sleep, and alternate unsuccessful attempts to vomit; subsequently sudden vomiting and very abundant alvine evacuations, after which great faintness, indifference to every thing, and sleep only a few minutes at a time. The younger, eight years of age, was even more violently attacked. Having understood that they had eaten the preceding day only a piece of old mouldy rye bread, Dr. Westerhoff prescribed a demulcent treatment, and they soon recovered.

Sometime afterward, several boatmen having eaten some mouldy rye bread were attacked with similar symptoms, but they were quickly relieved by vomiting, which came on spontaneously. The question suggested by these cases is whether this kind of poisoning arises from an alteration in the quality of the bread, or from the vegetation which constitutes mouldings, (*mucor mucedo.*)—*Archives Generales.*

Volcanic Island in the Mediterranean.

The Semaphore of Marseilles states, on the authority of the captain of a brig sailing between Trafani and Girgenti, that an Island was formed by a volcanic eruption in the middle of July, 1831, in that part of the Mediterranean. The phenomena are represented as very striking. An immense mass of water was thrown up to the heighth of 60 feet, accompanied by a sulphurous smoke, and a great noise. The result of the submarine explosion is an island in 37° 6′ north latitude, and 10° 26′ east longitude, from the meridian of Paris.

It is an active volcano, with a crater in its centre, whence lava flows. The sea all around is a hundred fathoms deep.

The last accounts of this island, from the Semaphore, state that the eruption had ceased, and that the crater is now filled with boiling water, from which a sulphurous smoke continues to issue. The island is chiefly formed of spongy lava and puzzolane. The brink of the crater is thirty feet in height at the lowest part, in other places eighty feet, and in the centre two hundred feet. It is easy to land on the south west side. Smoke issues from several points of the sea around.

Ancient Body found in a Bog in Ireland.

The body of a man, in a bog ten and a half feet deep, was found about nine feet below the surface. The abdomen was collapsed, but it, in all other respects, bore the appearance of recent death. The face was that of a youth of fine features, with hair long and black, loosely hanging over the shoulders. The dress, which was tight, and reached to the elbows and knees, was composed of the skin of an animal, probably the moose deer, laced with thongs, and having the hair inwards. There were no weapons, but a long staff or pole was laid on each side the body. Varro derives the Sagum of the Romans from the Sac, or skin dress of the Gauls and Britons, which probably was tight, and not flowing, from the nature of the material. The Suevi, according to Tacitus, wore flowing hair, and the staffs were familiar to the Silures, according to the same author. From the depth at which it was found, an immense period of time must have passed to admit of nine feet of vegetable matter having grown over the body, and all the circumstances concur to make it probable that the body was of a very remote period; for before the arrival of the English, the Irish wore, for the most part, ill made garments, made from their black sheep.—*Abstract of a paper in Edin. N. Phil. Jour. June,* 1831.

On the Phenomenon of Blushing.

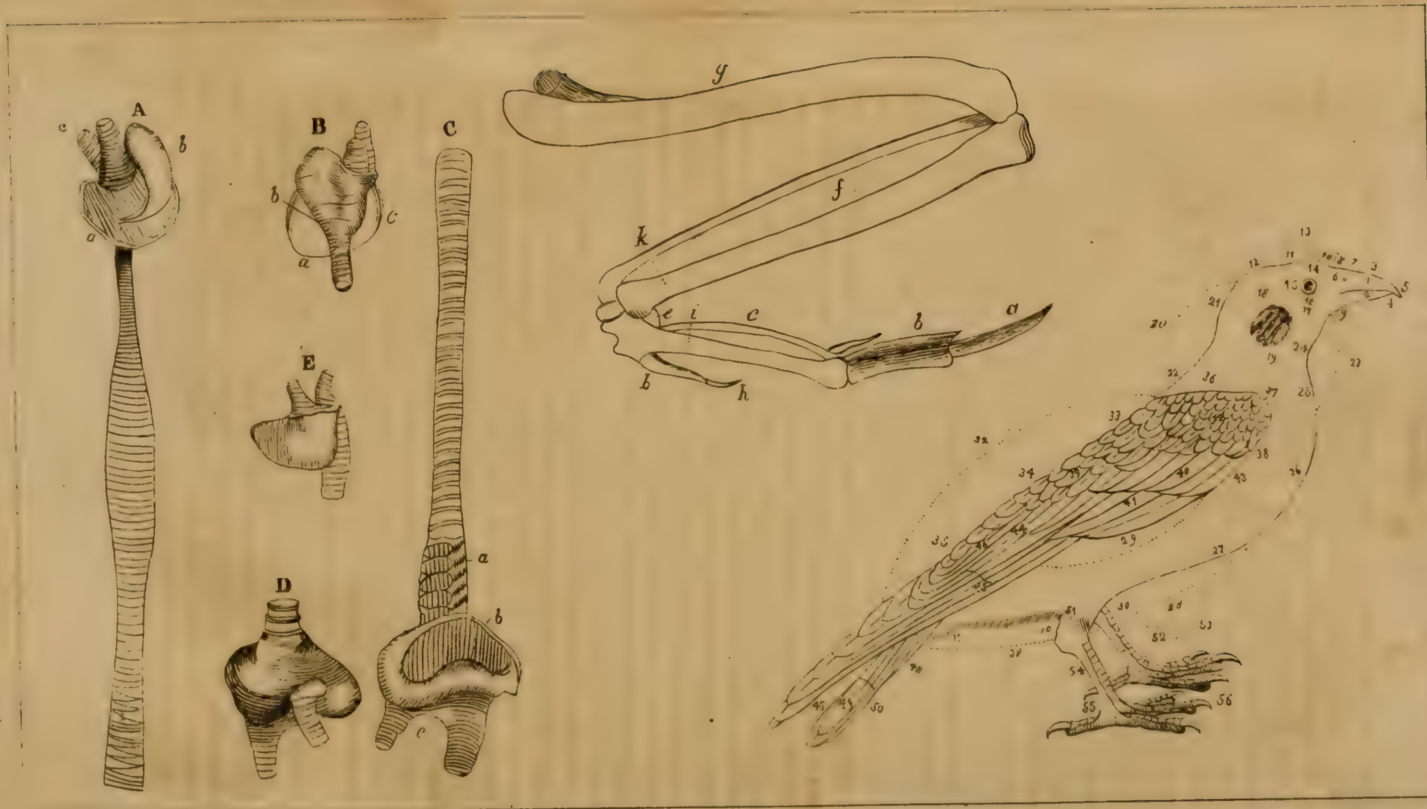
M. E. A. Lauth observes, that he is not aware that any precise information has been afforded as to the kind of vessels which produce the color of the face. Most physiologists merely say that it depends upon the capillaries. M. Lauth states, that if the arteries are successfully injected, the whole of the face becomes of an uniform red tint. It cannot, therefore, be these vessels which produce the phenomenon of blushing. He has derived the following results from a perfect injection of the facial veins: the cheeks were deeply colored, the chin, the tip of the nose and the forehead obtained a slighter tint, and the other parts of the face were still less colored. This kind of coloration resembles that which is produced by mental emotions during life, and we may therefore conclude that blushing depends in part upon venal congestion.—*Mem. de la Société, &c. de Strasbourg.*

METEOROLOGICAL JOURNAL,

Kept at Boston, for November, 1831.

	THERMOMETER.					BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Max.*	*Min.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	40	54	46	55	37	29.77	29.74	29.30	Cloudy	Fair	Fair	S.	S. W.	S. W.	0.02
2	41	54	43	55	40	29.88	29.92	29.97	Fair	Fair	Fair	S. W.	W.	N. W.	
3	37	52	38	51	38	30.00	30.00	30.08	Fair	Fair	Fair	N. W.	N. W.	N. W.	
4	33	49	46	50	34	30.18	30.14	30.12	Fair	Fair	Rain	N. W.	E.	N. E.	
5	37	52	38	55	38	30.10	30.15	30.19	Cloudy	Fair	Fair	S. W.	N. W.	N. W.	0.04
6	32	50	40	48	33	30.24	30.20	30.12	Fair	Fair	Fair	N. W.	N. W.	N. W.	
7	37	56	45	56	37	30.08	30.00	30.10	Fair	Fair	Fair	W.	W.	N. W.	
8	34	49	36	47	35	30.22	30.20	30.29	Fair	Fair	Fair	N. W.	N. W.	N. W.	
9	31	46	45	44	32	30.33	30.20	30.35	Fair	Cloudy	Cloudy	N. W.	E.	N. E.	
10	44	48	48	48	43	30.32	30.27	30.16	Cloudy	Cloudy	Rain	N. E.	N. E.	S. E.	
11	54	62	48	64	48	29.84	29.75	29.83	Cloudy	Fair	Fair	S. E.	S. W.	N. W.	0.46
12	38	52	42	48	38	29.90	29.87	29.90	Fair	Fair	Fair	N. W.	N. W.	N. W.	
13	39	50	44	50	38	29.85	29.74	29.68	Fair	Fair	Fair	N. W.	N. W.	S. W.	
14	39	43	39	43	38	29.55	29.51	29.60	Cloudy	Cloudy	Cloudy	S. W.	N. W.	N. W.	0.16
15	37	48	37	47	36	29.64	29.62	29.68	Fair	Fair	Fair	N. W.	N. W.	N. W.	
16	35	48	38	47	35	29.69	29.65	29.70	Fair	Fair	Fair	N. W.	N. W.	N. W.	
17	35	46	38	46	35	29.70	29.61	29.68	Fair	Fair	Fair	N. W.	N. W.	S. W.	
18	34	54	48	52	33	29.70	29.62	29.54	Fair	Fair	Cloudy	N. W.	N. W.	S. E.	0.92
19	44	50	38	50	37	29.40	29.45	29.61	Rain	Fair	Fair	S. W.	N. W.	N. W.	
20	36	42	40	44	33	29.71	29.70	29.72	Cloudy	Cloudy	Cloudy	N. W.	N. W.	N. W.	
21	33	46	41	45	33	29.77	29.75	29.69	Fair	Fair	Fair	N. W.	N. W.	S. W.	
22	40	42	36	42	36	28.99	28.86	28.62	Rain	Cloudy	Fair	N. E.	S. W.	N. W.	1.16
23	36	44	39	42	34	29.44	29.53	29.75	Fair	Fair	Fair	N. W.	N. W.	N. W.	
24	33	42	36	43	34	29.72	29.80	30.00	Fair	Fair	Fair	N. W.	N. W.	N. W.	
25	32	42	32	41	30	30.05	30.04	30.04	Fair	Fair	Fair	N. W.	N. W.	N. W.	
26	28	37	34	37	27	30.11	30.04	30.00	Fair	Cloudy	Snow	N. W.	N. W.	S. W.	
27	36	39	33	40	33	29.80	29.51	29.40	Rain	Rain	Snow	E.	E.	N. E.	0.68
28	27	36	27	37	27	29.52	29.60	29.65	Fair	Fair	Fair	N. W.	N. W.	N. W.	
29	23	30	23	28	22	29.50	29.50	29.72	Fair	Cloudy	Fair	N. W.	N. W.	N. W.	
30	22	28	19	27	20	30.02	30.00	30.00	Fair	Fair	Fair	N. W.	N. W.	N. W.	

Depth of water fallen, 3.44 inches.



Pendleton Lithog. Boston

THE NATURALIST.

FEBRUARY, 1832.

ORNITHOLOGY.

NO. II.

Trachea of Birds. The trachea, or *aspira arteria*, as the windpipe is scientifically called, is in some species of aquatic birds of a most singular structure, possessing an enlargement at the bottom, which has been termed a labyrinth. This labyrinthic part is of essential use to the ornithologist, in discriminating the species, as well before their arrival at maturity, as in the several changes of plumage incidental to season. With a view to promote a discovery so essential, we propose to fix names to the several parts in order to facilitate description.

In the labyrinthic part of the windpipe (*trachea*) there is a material difference in conformation, which forms two natural divisions, and, as might be expected, belong to birds of different habits; one is a structure found among the diving ducks with short wings, and some other birds that collect their food mostly under water; and as far as experience has gone, this line of separation appears constant. There are, indeed, one or two species which deviate somewhat from either division, but do not connect the two.

In order to explain this subject, we shall consider that the windpipe of such birds consists of three principal parts—that is to say, the windpipe, properly so called; the labyrinth, or swelling at the lower extremity; and the divarications at the bottom, (*bronchiæ*,) which connect the windpipe with the lungs. The principal distinction in the labyrinth of the two divisions is as follows :—

1. That which is composed of two distinct parts, one a compressed chamber, more or less covered with a thin membrane, situated on the left side of the windpipe, when in its proper place within the bird, which is called the drum, (*tympanum*,) at the back of which is another chamber, formed by the junction and inosculation of the base of the true divarications, the cartilaginous or bony wings of which are more or less united by ossification. This part has been termed a bony box, (*orca*,) from its being usually ribbed like a dice box, or the exterior and interior box. From the bottom of the exterior box, the flexible part of the right bronchial tube issues; the left bronchial tube arises from the base of the drum, and is not in immediate contact with the interior box, so that the respired air must first pass into the cavity of the drum, in order to be received into the lungs.

2. The labyrinth belonging to the grovelling ducks is much more simple; it consists of either one or two subglobular bony chambers, which have been called *ampulla*.

In most species of this division there is only one ampulla, and that is situated on the left side; but in the sheldrake there are two ampullæ, one on each side. Where there is only one ampulla, the right bronchial tube is connected with the windpipe; the left proceeds from the base of the ampulla. Where there are two ampullæ, the bronchiæ are partly connected with the bony base of the windpipe, and partly with the ampullæ, so that there is a free circulation of respiring air through those chambers.

The structure here described will be better understood by plate ii.

A represents the trachea of the white eye, (F. *nyroca*,) *a* the tympanum of the labyrinth—*b* the bony arch that crosses the tympanum—*c* the bronchiæ.

B labyrinth reversed—*a* the back of the tympanum—*c* the exterior orca—*b* the interior orca.

C trachea of the *Anas glacialis*—*a* the opening of the base covered by a transparent membrane—*b* the tympanum of the labyrinth—*c* the bronchiæ.

D labyrinth of the same reversed, showing the insertion of the bronchiæ.

E labyrinth of the Summer Duck, (A. *sponsa*,) showing the front of the ampulla.

External parts of Birds. The external parts of a bird which require to be noticed and distinguished by the naturalist, are the head, neck, body, wings, tail and legs; which parts are subdivided more or less minutely according to the

taste of various writers on the subject. We shall here give Montagu's description; but that this and similar ones may be better understood, we shall premise an explanation of the terms commonly employed in describing a bird. The figures prefixed to the terms refer to plate ii.

1. *Maxilla superior*, the upper mandible of the bill. 2. *Maxilla inferior*, the lower mandible of the bill. 3. *Culmen*, the ridge of the bill. 4. *Gonys*, the angle or point of the under mandible. 5. *Dertrum*, the hook of the bill. 6. *Nares*, the nostrils. 7. *Mesorhinium*, the upper edge of the bill. 8. *Lorum*, the bone, a naked space at the bill. 9. *Mentum*, the chin. 10. *Frons*, the forehead. 11. *Vertex*, the crown of the head. 12. *Sinciput*, the hinder part of the head. 13. *Capistrum*, the face. 14. *Supercilium*, the eyebrow. 15. *Rigio ophthalmica*, the region of the eye. 16. *Tempora*, the temples. 17. *Gena*, the cheek. 18. *Regio parotica*, the parts about the ear. 19. *Collum*, the neck. 20. *Cervix*, the hinder part of the neck. 21. *Nucha*, the nape of the neck. 22. *Auchenium*, the under nape of the neck. 23. *Guttur*, the throat. 24. *Gula*, the gullet. 25. *Jugulum*, the lower throat. 26. *Pectus*, the breast. 27. *Epigastrum*, the stomach. 28. *Abdomen*. 29. *Hypochondria*, the sides of the abdomen. 30. *Venter*, the belly. 31. *Crissum*, the vent. 32. *Dorsum*, the back. 33. *Interscapulum*, space between the shoulders. 34. *Tergum*, the middle of the back. 35. *Uropygium*, the rump. 36. *Humeri*, the shoulders. 37. *Flexura*, the bend of the wing. 38. *Axilla*, the armpit. 39. *Ala*, the wing. 40. *Tectrices*, the wing coverts. 41. *Tectrices majores*, the largest wing coverts. 42. *Tectrices minores*, the smallest wing coverts. 43. *Tectrices mediæ*, the middle coverts. 44. *Remiges*, the rowers. 45. *Primariæ*, the quills. 46. *Secundariæ*, secondaries. 47. *Cauda*, the tail. 48. *Rectrices*, the tail feathers, divided into, 49. *Intermediæ*, the middle, and, 50. *Laterales*, the side feathers. *Crus*, the leg, divided into, 51. *Tibia*, the thigh, answering to the leg in quadrupeds. 52. *Planta*, or *Pes*, the foot, divided into, 53. *Tarsus*, the shank, answering to the heel in quadrupeds, 54. *Acrotarsium*, the shin, 55. *Hallux*, the great toe, 56. *Digiti*, the toes.

Wings of Birds. The wing of a bird consists of five principal joints, with small auxiliary ones, as represented by plate ii. and by a comparison with the human arm, or the fore leg of a quadruped, we shall find there is a considerable similarity. The joints *a*, *b* and *c* answer to the *phalanges* of the fingers; *d* corresponds with the *metacarpus*, having two

small bones attached to it, at *e*, for the *carpus ; f* consists of two bones similar to those of the fore arm, the smaller is called the *ulna*, the larger the *radius ; g* is the *os humerus.* From *a* and *b* of the *phalanges*, and from the *metacarpal* joint *c*, arise the greater or primary quill feathers, usually consisting of ten or twelve. From the fore arm *f* spring the lesser or secondary quills, which cover the primaries when the wing is closed, consisting of twelve or fourteen feathers, according to the length of the wing.

The *os humerus g* bears what are called the tertials at the outer extremity, and at the other end is articulated into the *scapula*, and usually concealed by the scapular feathers ; *h* is the *alula spuria*, from whence those feathers arise which constitute the spurious wing ; this part answers to the thumb in the human hand, and in the wild swan (*Cygnus ferus*) it is furnished with a corneous claw, as represented at *h*.

Many ridiculous stories have been told of the great strength a swan possesses in his wings, and how dangerous it is to approach the nest of this bird, for a blow from its wing has been known to fracture a man's thigh. It is high time such absurdities should be erased in this philosophical age, and that the mind of man should reason before he continues to relate such accounts, only calculated to frighten children. Let the bones of the wing be examined, and compared with that of the thigh of a man, or even of his arm, (for it is well known the size and strength of muscles are in proportion to the size of the bone,) and it would be as impossible for a swan to break a man's arm, as it would be to break his head with a reed. The bone of a man's arm would bear a weight or pressure fifty times as great as the bone of a swan's wing ; how then is the inferior in size and strength to break the superior without at least being itself fractured ?

The pectoral muscles of all birds are proportionally stronger than the same muscles in the human frame, weight for weight ; but their bones, on account of their necessary levity, are thin, tubular, and consequently brittle, and ill calculated for partial concussion, though admirably suited for general and equal pressure against the yielding atmosphere. It should also be recollected, that a bird is incapable of striking with any degree of force while all his quill feathers are perfect, the resistance of the air against such a surface being too great to allow of its moving with sufficient velocity to inflict any sensible pain : to give the greatest impetus, the feathers should be cut short, as in the game cock trimmed for

fighting, the power of whose wings is greatly augmented by such a reduction of surface.

To those who may have a menagerie or a decoy, or wish to preserve the larger birds in confinement, it may be useful to know how to perform amputation upon that part of the wing of a bird, which will effectually prevent its escape, in as expeditious a manner, and with as little pain and risk as possible.

The usual method is that of cutting off a portion of the wing by a strong pair of scissors, or shears, and then with a red hot iron, searing the part, in order to stop the effusion of blood. The operation thus performed is tedious, painful, and not always attended with success; for as the principal artery contracts upon cutting the flesh, the part has been known to be grilled for ten minutes with a red hot poker, without closing the mouth of the artery, and the bird die in consequence of the loss of blood.

Supposing then, that only eight or nine of the greater quills are wanted to be taken off, which is sufficient for the duck tribe, the place for amputation is at *i*. For short-winged birds, such as the partridge, the operation is best performed at *k*, for these birds can rise a considerable way from the ground with the loss only of part of the primary quills.

In order to perform the operation at either of these places, the operator should be furnished with a long needle and coarse strong thread, which should be used double. Let the bird be held by an assistant, and having cut away the small feathers of the wing at the part intended to be amputated, pass the needle through between the two bones, as close as possible to the lesser one, taking the inside of that bone for guiding the point of the needle. Return the needle on the opposite side of the great bone, a little within the skin, then bring the two ends together, and make a double turn in the first knot, to prevent slipping after tying, and draw the knot strongly, so as to form a ligature upon the vessels, and then tie a second knot. It will be obvious that by this ligature the larger bone and the greater part of the flesh are inclosed, and as the main artery, or its principal branch, lies on the inside of that bone, amputation may then be performed with safety, and the ligature need never be removed. It now only requires to place the wing on a block of wood, and with a sharp knife and a hammer, to take the pinion off about the eighth of an inch below the ligature.

It will be readily perceived that a ligature tied round the two bones would not compress the main artery; besides, by

inclosing only a part of the limb, the ligature is not only secure from slipping, but the stump more readily heals.

If the wing of a bird is fractured by a shot as high up as the joint *g*, the same operation may be performed with safety by passing the needle and thread a little within the skin, on each side the bone, just above the fractured part, and tying it as before described; then with a sharp knife, cut the flesh round at the fracture, and if any splinter of the bone projects, it should be snipped off with a cutter, or a pair of scissors, as close as possible to the flesh. In all these cases, the bird may be set at liberty as soon as it is perceived that the ligature has been sufficiently tightened to prevent bleeding, and never require any further care.

When the amputation is performed at *i* of joint *c*, the spurious wing (*Alula spuria*) should be suffered to remain as it gives a finish to the wing, and hides the stump.

Feet of Birds. The large crooked talons of birds of prey, and their hooked beaks, are well formed for securing and tearing their victims. The formation of the feet of woodpeckers, the toes being placed two forward and two backward, is well calculated for climbing; and the cuniform shape of the extremity of their bills is suited to the purpose of cutting holes in decayed trees; their tongue is also wonderfully contrived to search out insects beyond the reach of their bill, by its great length, which is double that of the bill at least.

The legs and feet of aquatic birds are wonderfully formed for accelerating their motion in that element, which is their greatest security. The bone of the leg is sharp, and vastly compressed sideways; the toes, when the foot is brought forward, close in behind each other in such a manner as to expose a very small surface in front, so that, in the action of swimming, very little velocity is lost in bringing the legs forward; this is very conspicuous in the diver. Some aquatic birds are web-footed before the whole length of the toes, as in the ducks; others only half the length of the toes. Some again have all four toes webbed; the feet of others are furnished with a fin-like membrane on each side of their toes. There are also some which swim and dive well, whose toes are long and slender, and not furnished with webs or fins, such as the water hen and rail; but these live as much on land as in water. The gulls and terns, although web-footed, seem incapable of diving; the latter, indeed, never settles on the water; the former is so buoyant that it floats elegantly on the surface.

Nictitating Membrane of Birds. As birds are continually passing among hedges and thickets, their eyes are protected from external injuries, as well as from too much light when flying in opposition to the sun's rays, by a nictitating or winking membrane, which can at pleasure be drawn over the whole eye like a curtain. This covering is neither opaque, nor wholly pellucid, but somewhat transparent. By means of it the eagle is said to gaze at the sun.

Vision of Birds. Ross in his voyage to Baffin's Bay, proved that a man under favorable circumstances could see over the surface of the ocean to the extent of 150 English miles. It is not probable that any animal exceeds this power of vision, though birds, perhaps excel men and most quadrupeds in sharpness of sight. Schmidt threw at a considerable distance from a thrush (*Turdus musicus*) a few small beetles of a pale gray color, which the unassisted human eye could not discover, yet the thrush observed them immediately and devoured them. The bottle tit (*Parus caudatus*) flits with great quickness among the branches of trees, and finds on the very smooth bark its particular food, where there is nothing perceptible to the naked eye, though insects can be detected there by the microscope.

In a recent number of the Medico Chirurgical Review, Dr. James Johnson has shrewdly combatted the opinion, that birds of prey could scent, and thinks that they are usually, if not uniformly, guided by vision.

'It has always appeared to us,' says he 'most extraordinary, indeed unacountable, that birds of prey scent carcasses at such a distance as they are said to do. We were led to scepticism on this subject, some twenty years ago, while observing the concourse of birds of prey from every point of the horizon, to a corpse floating down the river Ganges and *that* during the north-east monsoon, when the wind blew from one point of the compass for months in succession. It was extremely difficult to imagine that the effluvia from a putrifying body in the water could emanate in direct opposition to the current of air, and infringe on the olfactories of birds many miles distant. Such, however, were the *dicta* of natural history, and we could only submit to the general opinion. We have no doubt, now that we know the general opinion to be something wrong, that it was by means of the optic rather than the olfactory nerve, that those birds found out their quarry.

'The toucan ranks next to the vulture in discerning whether by smell or by sight, the carrion on which it feeds. The immense size of its bill, which is many times larger than its head, was supposed to present, in its honeycomb texture, an extensive prolongation of the olfactory nerve, and thus to account for its power of smelling at great distances; but, on accurate examination, the texture above mentioned in the bill, is found to be a mere *diploe* to give strength to the bill. Now the eye of this bird is somewhat larger than the whole brain; and it has been ascertained by direct experiments, that, where putrid carrion was inclosed in a basket, from which effluvia could freely emanate, but which concealed the offal from sight, it attracted no attention from the vultures and other birds of prey till it was exposed to their view, when they immediately recognized their object, and others came rapidly from different quarters of the horizon, where they were invisible a few minutes before. This sudden appearance of birds of prey, from immense distances, and in every direction, however the wind may blow, can only be accounted for by their soaring to an attitude. In this situation their prey on the ground is seen by them, however minute it may be, and their appearance is merely their decent from high regions of the atmosphere, to within the scope of our optics.'

Lubrication of the Feathers of Birds. The feathers of birds would constantly imbibe moisture of the atmosphere, and, during rain, absorb so much wet, as would almost, if not wholly, impede their flight, had not the wise economy of nature obviated this by a most effectual experiment. They are furnished on the rump with two glands, in which a quantity of unctuous matter is constantly secreting. This is occasionally pressed out by means of the bill, and used for the lubrication of the feathers. The birds which share, as it were, the habitations of man, and live principally under cover do not require so large a supply of this fluid, and, consequently, are not provided with such a large stock of it as those that rove abroad, and reside in the open element. Hence poultry, when wet, assume a ruffled and uncomfortable appearance.

THE WILD TURKEY.

This splendid bird extends from the North West Territory of the United States to the isthmus of Panama. They abound in the forests and unsettled parts of the Union, but are not numerous in Florida, Georgia, or the Carolinas. They are very rare in the northern and eastern parts of the United States. They were formerly abundant in Canada, but as their places of resort become settled and thickly peopled, they retire and seek refuge in the remotest recesses of the interior. In New England it appears to have been destroyed many years ago, but they are still found in the eastern parts of Pennsylvania and New Jersey.

These birds do not confine themselves to any particular food, but eat corn, berries, grapes, barley, tadpoles, young frogs and lizards. Their favorite food, however, is the pecannut and acorn. Where there is an abundant crop of acorns, there numerous flocks of turkeys may be expected. In the fall

they direct their courses in vast numbers to the rich lands on the borders of the Ohio and Mississippi. The males and females travel separately, but all in the same direction. Before crossing a river, they assemble on the highest eminences, and remain there as if in consultation for a day or two. At length after due preparation, the leader gives a signal note, and they all wing their way to the opposite shore. Some of the young and weak fall into the water and are obliged to swim for their lives, using all the means in their power and the most violent exertions to reach the shore. Many however perish in the attempt. It is observed that after these journeys, the turkeys are so familiar, that they fearlessly enter the plantations in search of food. Great numbers are killed at this time, and kept in a frozen state to be sent to distant markets.

They begin to build in April; the nest is very simple in construction, being only composed of a few dried leaves. The female lays sometimes twenty, but more usually nine or fifteen eggs, which are white, spotted with brown. Wild turkeys are very tenacious of their feeding grounds, as well as of the trees on which they have once roosted. Flocks have been known to resort to one spot for a succession of years, and to return after a distant emigration in search of food. They roost on a point of land jutting into a river where there are large trees in great numbers. When they are all quiet for the night, they are very easily shot, and an experienced hunter may secure nearly the whole flock, as the turkeys, fancying themselves secure when at roost, are not alarmed by either the sportsman or his gun.

The flesh of the wild turkey is of excellent flavor, being more delicate and juicy than that of the domestic turkey; the Indians value it so highly, that they term it, when roasted, 'the white man's dish.'

The male of the wild turkey is nearly four feet in length; the female is only three feet and a quarter long. The plumage of the male is very brilliant, and of a variety of hues; that of the female is not as beautiful. When strutting abroad and displaying himself, this bird has a very stately and handsome appearance, and appears to be quite sensible of the admiration he excites.

A new species, called the ocellated turkey, has been discovered in Honduras, which is of a smaller size and of more brilliant plumage than the turkey of the United States. It has small ocellated spots on the tail.—*Buffon's Nat. History.*

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. II.

'Silk, and the many textures wrought from this beautiful material, are so universally and familiarly known, that the peculiar manner of its production cannot fail to be a subject of interesting investigation.

'It is a wonderful fact, that the thick velvet and the stiff brocade, the thin gauze and the delicate blonde, should all be formed from the product of the labors of a little worm; and we are irresistibly prompted to inquire how such results are accomplished.

'To trace from their origin, the progressive steps by which man has adapted to his use the various productions of nature, is rarely possible. All that can be collected concerning several of the important arts of life is, that they have flowed to us from the East, and that many among them have issued from China in a state of comparative perfectness.

'It is impossible to fix the period when man first divested the chrysalis of its dwelling, and discovered that the little yellow ball, which adhered to the leaf of the mulberry tree, could be evolved into a slender filament, and thence be made to form tissues of endless beauty and variety. From a certain point, we can trace the progressive improvements of the silk manufacture, but seek in vain for authentic information respecting its earliest origin; and, while compelled to assign the merit of this to the Chinese, we cannot account for the degree of excellence which the art had attained previous to the time when even the existence of the material became known in the West. This proficiency alone, however, affords sufficient proof that the manufacture was of no recent origin. The manual arts arrive at perfection by very slow degrees. Improvements resulting from invention, as distinguished from imitation, are seldom rapid; and if this position hold good as a general principle, it is more especially applicable to labors unassisted by any save the rudest machinery, and practised by a people who, so far at least as we are informed, could derive little aid from science.

'Notwithstanding these disadvantages, the Chinese, in the remotest ages, produced sugar, silk and many other manufactures, with a degree of excellence which even now is scarce-

ly surpassed. Yet while other nations have been rapidly advancing in knowledge, they have remained stationary. Debarred from intercourse with their kind, less by the obstructions which they raised to the ingress of strangers, than by the vanity which led them to make so false an estimate of other nations, this extraordinary people drew upon the resourses of their own intelligence for discoveries the most important, and pursued them to an useful end with industry the most persevering. Their industry remains, but the intelligence to which it owed its principal value appears to have been arrested. In the faculty of imitating, they are still considered unrivalled; but this is a quality which would seem to place them in the train of other nations, rather than as taking the lead in discovery and civilization.'

To trace the origin and progress of the manufacture of this delicate luxury, is irrelevant to our present purpose. Our only object is to give its history from the first introduction into this country up to the present time, in order to show the practicability of its being raised and manufactured here.

The first introduction of the silk culture into the United States was made by James I. 'who was anxious to introduce the silk worm into his American colonies, and several times urged the Virginian company to promote the cultivation of mulberry trees and the breeding of silk worms. He addressed a letter to them expressly on this subject, in 1622, conveying to them strict injunctions that they should use every exertion for this purpose, and should stimulate the colonists to apply themselves diligently and promptly to the breeding of silk worms and the establishment of silk works; bestowing their labors rather in producing this rich commodity, than to the growth of "that pernicious and offensive weed," tobacco—an article to which his majesty has recorded and published his violent aversion.

'The company, thus incited, showed much zeal in their endeavors to accomplish the king's wishes. They lost no time in transmitting his majesty's letter to the governor and council of Virginia, together with particular instructions how the colonists might best employ their labors in the production of silk. For the furtherance of this object, their instructions were accompanied by several copies of a work on the management of the silk worm, written by Mr. John Bonoeil. This gentleman, who was a member of the Virginia company, engaged warmly in the undertaking; and was so fully convinced of its practicability, as to assert that, with an adequate number of hands, such a quantity of silk might

be produced in Virginia, as in a very short time would sufficiently supply all christendom.

'The misfortunes soon after this time experienced by the colony of Virginia, and which involved the dissolution of the company, materially checked the execution of this project. A considerable number of mulberry trees were planted, and flourished; but little silk was produced.

'In the year 1654, the rearing of silk worms again became a subject of interest in Virginia. This revival was principally owing to the exertions of Mr. Edward Diggs, who confidently asserted that he had conquered all the main difficulties attending the experiment. He endeavored to persuade the Virginians that in a short time a great quantity of silk might be very profitably obtained; but it does not appear that the production was ever carried to any extent in that colony. It is probable that the planters found a source of greater profit in the growth of tobacco, for which they met with a ready market both in the mother country and the north of Europe.

'A renewed attempt to produce silk in England appears to have been made in the year 1629. This may be inferred from a grant having then been made to Walter Aston, of the custody of the garden, mulberry trees, and silk worms, near St. James's, in the county of Middlesex; although this may possibly have been a continuation of king James's project of the year 1608. The scheme was once again revived in 1718; a patent having at that time been granted to John Appleton, Esq. for producing raw silk of the growth of England. To accomplish this undertaking, he was authorised to raise a fund by joint stock subscription. This he accomplished, dividing the capital into shares of five pounds each. A deed of trust was executed, and enrolled in the court of chancery; directors for managing the concerns of the company were chosen by the subscribers, and Chelsea park, being conveniently situated, and possessing a soil favorable for the purpose, was fixed upon as the spot on which the operations should be conducted. A lease of this place for 122 years was obtained, and 2000 mulberry trees were soon actually planted; this forming but a small part, however, of the vast quantity which the company contemplated raising. Many large edifices were erected at a great expense upon the spot, the remains of which are at present scarcely discernible. Mr. Henry Barham, who probably was a member of this company, published at this time an essay on the silk worm, wherein he labored to prove that all objections

and difficulties raised against the prosecution of what he calls "this glorious undertaking," were mere phantoms. The event, however, proved him to be wrong; and showed that difficulties did exist of an insurmountable description: for although it was confidently predicted that in the ensuing year a considerable quantity of raw silk would be produced, the expectation was disappointed, and the company soon sunk into oblivion.

'This undertaking had arisen among the crowd of speculations conceived at that period, which produced such disastrous results—projects, whether rational or chimerical, which were all alike eagerly embraced by the insensate multitude. The dreadful revulsion which followed may account for the rapid extinction of a scheme, the projectors of which had contemplated such splendid advantages.

'In the earliest infancy of the settlement of Georgia, in the year 1732, a piece of ground belonging to government was allotted as a nursery plantation for white mulberry trees, and the attention of some of the settlers was soon engaged in rearing silk worms. This branch of industry gradually, although slowly, increased, both in Georgia and South Carolina; and it appearing desirable that this country (England) should be enabled to draw supplies from its colonies, rather than be dependent upon foreign states for a material of continually growing importance to its manufactures, an act of parliament was passed in 1749 for encouraging the growth of colonial silk, under the provisions of which, all that was certified to be the production of Georgia and Carolina, was exempted from the payment of duty on importation into the port of London. Encouraged by the increasing growth of raw silk in these colonies, which induced a belief, that by the adoption of more judicious plans an abundant supply might be drawn from them, sufficient to answer all the demands of our manufacturers, a bounty was offered for the production of silk, and an Italian gentleman, named Ortolengi, was engaged, at a suitable salary, to proceed to Georgia and instruct the colonists in the Italian mode of management. Although, for a time, hopes were entertained that the Georgians might find in this pursuit a valuable branch of industry, yet, in consequence of one or two unfavorable seasons, and still more from the quality of the silk proving very indifferent, its culture soon began to decline, and the lessening of the bounty became a signal for its abandonment by the planters. A small quantity was still raised by the poorest of the peasantry; but before

the close of the eighteenth century the production of silk was wholly discontinued in Georgia.

'There is no doubt that the cultivation of the cotton plant, which in the mean time had been introduced, proved so advantageous to the planters in Georgia, as to render a furthcr prosecution of the precarious and less profitable silk product distasteful.

'The rearing of silk worms had been an object of interest in Carolina so early as the year 1732. This branch of industry was undertaken principally by the small farmers, many of whom produced from forty to fifty pounds' weight of silk in the season. The endeavors to increase and perfect its production in this colony were long persevered in. In the year 1771, Louis de St. Pierre made a representation to government, that at the expense of his whole fortune he had brought to perfection the art of making wine and the production of silk at New Bourdeaux. His specimens of wine and silk, which were transmitted to England, were thought deserving of notice by the patriotic Society for the Encouragement of Arts, which testified its approbation of M. St. Pierre's exertions by presenting him with their gold medal, accompanied with a premium of fifty pounds. Notwithstanding this stimulus to further efforts, the quantities afterwards raised were small, and the cost of production proved too great for successful competition with silk of other countries.

'A project was formed many years back to extend the culture of the white mulberry tree over all the states of the American Union, and a considerable number was planted in consequence. In the year 1789 a very extensive nursery of these trees was established near Philadelphia; another at Princeton, in New Jersey; one at New York, and a fourth on Long Island. The states considered it politic to establish these nurseries, with the idea that in the then unsettled state of Europe, emigrants from the silk countries might be allured to a place where provision was already made for enabling them to pursue their accustomed employment. This expectation does not appear in any case to have been realized.

'The project of rearing silk worms in the United States of America has very recently been renewed, and a small package of silk, the result of this attempt, was, early in the present year (1831,) imported into Liverpool.

'The president of the American Philosophical Society established in Philadelphia, M. Du Ponceau, has for some time been desirous of encouraging this branch of rural economy,

and lately established a filature, under the direction of M. D. Homergue, who, having conducted a similar undertaking at Nismes, in France, is possessed of the requisite knowledge and experience.

'The quality of the silk hitherto produced in Pennsylvania is said fully to equal that of Bengal: it promises to stand well the various processes of dyeing and weaving; but, as might be expected in the commencement of such an undertaking, the operation of reeling has not been conducted with the requisite degree of skill. The attempt has hitherto been made on too small a scale for the projector to form any satisfactory opinion upon the issue as regards its profitableness; and it yet remains to be seen whether the Philadelphians are in possession of facilities for this pursuit, which will counterbalance the high rate of wages prevalent throughout the state, and which would otherwise give a decided advantage in point of price to the raw silks of Italy and India, even in the markets of the United States.

'The subject has appeared to be of so much importance to the American legislature, that a committee of congress has recommended the project to the attention and protection of the government.'

In Connecticut, attention was first directed to the introduction of the silk worm in 1760. Dr. Aspinwall, of Mansfield, urged on by patriotism, used his best exertions to introduce the culture of silk. He succeeded in making commencements at New Haven, on Long Island and at Philadelphia, by causing orchards of mulberry trees to be planted. He had a warm and zealous coadjutor, the Rev. Dr. Stiles of New Haven. One half of an ounce of mulberry seeds was sent to every parish in the state of Connecticut with such directions as their knowledge of the business enabled them to impart.* Through their exertions the legislature in 1783 was induced to grant a bounty on mulberry trees and raw silk. From some cause, which does not appear, the legislature in a few years withdrew the bounty. In 1793 there were raised in Mansfield 265 lbs. of raw silk. It being the residence of Dr. Aspinwall, it is probable, from his well known zeal in the cause, that this result was owing in some measure to his superintendence and direction.

But instead of tracing the progress of this industry minutely, its importance will be shown with equal force, by glancing

* Why would it not be a laudable act of patriotism for our present clergy to adopt similar measures? ED.

at results in different periods. Thus in 1827, Mansfield produced 2430 pounds—and the county of Windham alone in 1826, manufactured $54,000 worth of silk—although the proceeds of three counties, from this branch, in 1810, amounted to less than $29,000. The town of Mansfield has raised the last season *five tons ;* and the culture is rapidly extending in Coventry and other neighboring towns. One gentleman in this state, last year, paid $1500 for white mulberry trees, with which he has set out an orchard of 100 acres. About 1000 bushels of cocoons were sent to Philadelphia last season and were sold for $3 a bushel.

A short time since a few enterprising individuals of Mansfield united and established a small silk factory under the direction of Mr. Edward Golding, a regular-bred English manufacturer of silk. They have 32 swifts, for winding hard silk ; 32 spindles for doubling ; 84 spindles for throwing ; 84 spindles for spinning ; 32 spindles for soft silk winding ; and 2 broad and 1 fringe silk looms. There is machinery enough prepared to keep 30 broad silk looms in operation. They have only 11 hands employed at present, but 50 could be employed to advantage. The sales of sewing silk in this town alone the past year are estimated at upwards of $85,000.

There is every reason to believe that a rapid increase of this production will soon take place in many of the states of the Union. In New Hampshire and Vermont, silk has been cultivated in small quantities with advantage. Individuals in Massachusetts have cultivated it with success for more than 50 years. Mr. Enoch Boynton, of Newbury, has been engaged in the business for 40 years, and is convinced of the utility and practicability of its being pursued as a lucrative branch of business. He says that the inhabitants of the United States can be clothed with silken goods, with less land and less labor than with flax, wool or cotton; and that it can be made impervious to water, for outside garments, while cotton, wool and flax can be made useful for inside ones. He has made considerable improvement on his silk mill, which will no doubt be of utility. It is calculated to wind from the cocoons threads of various sizes, suitable for any fabric wanted.

Mr. J. H. Cobb, Esq. of Dedham has been successfully engaged in the business for several years, both in rearing the worms and manufacturing the silk. By a great deal of patience, perseverance and industry, he has brought into operation most of the machinery that is used in England, and upon an improved plan, particularly for preparing silk. He has in operation winding, tramming and throwsting machines and

looms, under the superintendence of an Englishman well skilled in the art. What amount of machinery he has we are unable to say, but we are informed that he has more than they have at Mansfield, and is still increasing it.

From the preceding remarks it is evident that our country is well adapted to the culture of silk, and that it can be manufactured here with the same facilities as it can in Europe; that there is no branch of agriculture which can be pursued that is more lucrative than this. Suffice it here to say, that like the culture of the vine, a degree of perseverance and enthusiasm seems to pervade all the votaries of this delightful pursuit, and a warm and friendly interchange of views and sentiments exists among them, which has been comparatively unknown in any other species of culture. Similar sentiments and like prospects of success seem to pervade all parts of our country when it has received merited attention, and the daily increasing devotion to the subject will ere long cause each section of our Republic to respond to the other.

HUMAN LONGEVITY.

[From the Encyclopædia Americana.]

The extreme limit of human life, and the means of attaining it, have been a subject of general interest, both in ancient and modern times, and the physiologist and political economist are alike attracted by the inquiry. It is for the student of biblical antiquities to decide in what sense we are to understand the word *year* in the scriptural accounts of the antediluvians; whether it signifies a revolution of the sun or of the moon, or whether their extreme longevity is only the creation of tradition. In the sense which we now give the the word *year*, the accounts would make the constitution of men at the period referred to, very different from what it is at present, or has been, at any period from which observations on the duration of human life have been transmitted to us. The results of all these observations, in regard to the length of life in given circumstances, do not essentially differ. Pliny affords some valuable statistical information, if accurate, regarding the period at which he lived, obtained from an official, and, apparently, authentic source—the census, directed by the emperor Vespasian, in the year 76 of the Christian era. From this we learn that, at the

time of the computation, there were, in the part of Italy comprised between the Apennines and the Po, 124 individuals aged 100 years and upwards, viz. 54 of 100 years, 57 of 110, 2 of 125, 4 of 130, 4 of 135 to 137, and 3 of 140. At Parma, a man was living aged 120, and 2 aged 130; at Faenza, a female aged 132; and at a small town near Placentia, called Velleiacium, lived 6 persons aged 110 years each, and 4 of 120. These estimates, however, do not accord with those of Ulpian, who seems to have taken especial care to become acquainted with the facts of the case. His researches prove that the expectation of life in Rome, at that time, was much less than it now is in London, or in any of our cities. Hufeland, indeed, in his *Macrobiotics*, asserts that the tables of Ulpian agree perfectly with those afforded by the great cities of Europe, and that they exhibit the probabilities of life in ancient Rome to have been the same as those of modern London. But Dr. F. Bisset Hawkins, in his Elements of Medical Statistics (London 1829), says that the tables, kept by the censors for 1000 years, and constituting registers of population, sex, age, disease, &c., according to Ulpian, (who was a lawyer, and a minister of Alexander Severus,) refer only to free citizens, and that, to draw a just comparison between Rome and London, it would be necessary to take, among the inhabitants of the latter city, only those who were similarly circumstanced, viz. those whose condition is easy; in which case, the balance would be greatly in favor of modern times. Mr. Finlayson has ascertained, from very extensive observation on the decrement of life prevailing among the nominees of the Tontines, and other life annuities, granted by the authority of parliament, during the last 40 years, that the expectation of life is above 50 years for persons thus situated, which affords the easy classes of England a superiority of 20 years above even the easy classes among the Romans. The mean term of life among the easy classes of Paris is, at present, 42 years, which gives them an advantage of 12 years above the Romans. In the third century of the Christian era, the expectation of life in Rome was as follows: From birth to 20, there was a probability of 30 years; from 20 to 25, of 28 years; from 25 to 30, 25 years; from 30 to 35, 22 years; from 35 to 40, 20 years; from 40 to 45, 18 years; from 45 to 50, 13 years; from 50 to 55, 9 years; from 55 to 60, 7 years; from 60 to 65, 5 years. Farther than this the computation did not extend. The census taken from time to time in England affords us information of an unquestionable character. The first actual enumeration of the inhabitants was made in

1801, and gave an annual mortality of 1 in 44.8. The third and last census was made in 1821, and showed a mortality of 1 to 58. The mortality then had decreased considerably within 20 years. In France, the annual deaths were, in 1781, 1 in 29; in 1802, 1 in 30; in 1823, 1 in 40. In the Pays de Vaud, the mortality is 1 to 49; in Sweden and Holland, 1 to 48; in Russia, 1 to 41; in Austria, 1 to 28. Wherever records have been kept, we find that mortality has decreased with civilization. Perhaps a few more persons reach extreme old age among nations in a state of little cultivation; but it is certain that more children die, and the chance of life, in general, is much less. In Geneva, records of mortality have been kept since 1590, which show that a child born there has, at present, five times greater expectation of life than one born three centuries ago. A like improvement has taken place in the salubrity of large towns. The annual mortality of London, in 1700, was 1 in 25; in 1751, 1 in 21; in 1801, and the 4 years preceding, 1 in 35; in 1811, 1 in 38; and in 1821, 1 in 40; the value of life having thus doubled, in London, within the last 80 years. In Paris, about the middle of the last century, the mortality was 1 in 25; at present, it is about 1 in 32; and it has been calculated that, in the fourteenth century, it was one in 16 or 17. The annual mortality in Berlin has decreased during the last 50 or 60 years, from 1 in 28 to 1 in 34. The mortality in Manchester was, about the middle of the last century, 1 in 25; in 1770, 1 in 28: 40 years afterwards, in 1811, the annual deaths were diminished to 1 in 44; and, in 1821, they seem to have been still fewer. In the middle of the last century, the mortality of Vienna was 1 in 20; it has not, however, improved in the same proportion as some of the other European cities. According to recent calculation, it is, even now, 1 in 22½, or about twice the proportion of Philadelphia, Manchester or Glasgow. The following is the annual mortality of some of the chief cities in Europe and this country:

Philadelphia,	1 in 45.68	Berlin,	1 in 34
Glasgow,	1 in 44	Paris, Lyons, Barcelona and Strasburg,	1 in 32
Manchester,	1 in 44	Nice and Palermo,	1 in 31
Geneva,	1 in 43	Madrid,	1 in 29
Boston,	1 in 41.26	Naples,	1 in 28
London,	1 in 40	Brussels,	1 in 26
New York,	1 in 37.83	Rome,	1 in 25
St. Petersburg,	1 in 38	Amsterdam,	1 in 24
Charleston,	1 in 36.50	Vienna,	1 in 22 1-2
Baltimore,	1 in 35.44		
Leghorn,	1 in 35		

From Dec. 12, 1828, to Dec. 15, 1829, in London, the whole number of deaths was 23,525. The proportion of deaths, in different ages, was as follows:

Under two years of age,	6710	Fifty and sixty,	2094
Between two and five,	2347	Sixty and seventy,	2153
Five and ten,	1019	Seventy and eighty,	1843
Ten and twenty,	949	Eighty and ninety,	749
Twenty and thirty,	1563	Ninety and one hundred,	95
Thirty and forty,	1902	One hundred and one,	1
Forty and fifty,	2093	One hundred and eight,	2

On the average of eight years, from 1807 to 1814 inclusive, there died annually within the city of Philadelphia and the Liberties, the following proportion of persons, of different ages compared with the total number of deaths:

	Per cent.		Per cent.
Under one year,	25.07	Fifty to sixty,	5.95
From one to two years,	10.71	Sixty to seventy,	4.29
Two to five,	5.67	Seventy to eighty,	3.27
Five to ten,	3.00	Eighty to ninety,	1.89
Ten to twenty,	3.60	Ninety to one hundred,	0.50
Twenty to thirty,	8.63	One hundred to one hundred ten,	0.0009
Thirty to forty,	10.99		
Forty to fifty,	7.98		

Another question of interest is the inquiry in what degree the various trades and professions are favorable to human life, or the contrary. Several statements have lately been published respecting this subject, but farther and more copious observations are required, to afford satisfactory results.

The Literary Gazette gives, in a tabular form, the results of a work on this subject, from the pen of Mr. Thackrah, an eminent surgeon of Leeds.—*Out-of-door occupations.* Butchers are subject to few ailments, and these the result of plethora. Though more free from diseases than other traders, they, however, do not enjoy greater longevity; on the contrary, Mr. Thackrah thinks their lives shorter than those of other men, who spend much time in the open air. Cattle and horse dealers are generally healthy, except when their habits are intemperate. Fishmongers, though much exposed to the weather, are hardy, temperate, healthy and long-lived; cartdrivers, if sufficiently fed, and temperate, the same. Laborers in husbandry, &c., suffer from a deficiency of nourishment. Brickmakers, with full muscular exercise in the open air, though exposed to vicissitudes of cold and wet, avoid rheumatism and inflammatory diseases, and attain good old age. Paviers are subject to complaints in the loins, increasing with age, but they live long. Chaisedrivers, postilions, coachmen, guards,

&c., from the position of the two former on the saddle, irregular living, &c., and from the want of muscular exercise, in the two latter, are subject to gastric disorders, and, finally, to apoplexy and palsy, which shorten their lives. Carpenters, coopers, wheelwrights, &c., are healthy and long-lived. Smiths are often intemperate, and die comparatively young. Rope-makers and gardeners suffer from their stooping postures.—*In-door occupations.* Tailors, notwithstanding their confined atmosphere and bad posture, are not liable to acute diseases, but give way to stomach complaints and consumption. The prejudicial influence of their employment is more insiduous than urgent: it undermines rather than destroys life. Stay-makers have their health impaired, but live to a good age. Milliners, dressmakers and straw bonnet makers, are unhealthy and short-lived. Spinners, cloth-dressers, weavers, &c., are more or less healthy, according as they have more or less exercise and air. Those exposed to inhale imperceptible particles of dressings, &c., such as frizers, suffer from disease, and are soonest cut off. Shoemakers are placed in a bad posture. Digestion and circulation are so much impaired, that the countenance marks a shoemaker almost as well as a tailor. We suppose that, from the reduction of perspiration, and other evacuations, in this and similar employments, the blood is impure, and, consequently, the complexion darkened. The secretion of bile is generally unhealthy, and bowel complaints are frequent, In the few shoemakers who live to old age, there is often a remarkable hollow at the base of the breast bone, occasioned by the pressure of the last. Curriers and leather-dressers are very healthy, and live to old age. Saddlers lean much forward, and suffer, accordingly, from headache and indigestion. Printers (our worthy co-operators) are kept in a confined atmosphere, and generally want exercise. Pressmen, however, have good and varied labor. The constant application of the eyes to minute objects gradually enfeebles these organs. The standing posture, long maintained here, as well as in other occupations, tends to injure the digestive organs. Some printers complain of disorder of the stomach and head, and few appear to enjoy full health. Consumption is frequent. We can scarcely find or hear of any compositor above the age of 50. In many towns, printers are intemperate. Bookbinders,—a healthy employment. Carvers and gilders look pale and weakly, but their lives are not abbreviated in a marked degree. Clockmakers are generally healthy and long-lived; watchmakers, the reverse. House servants, in large, smoky towns, are unhealthy.

Colliers and well-sinkers,—a class by themselves,—seldom reach the age of 50.—*Employments producing dust, odor or gaseous exhalations.* These are not injurious, if they arise from animal substances, or from the vapor of wine or spirits. Tobacco manufacturers do not appear to suffer from the floating poison in their atmosphere. Snuff making is more pernicious. Men in oil mills are generally healthy. Brush-makers live to a great age. Grooms and hostlers inspire ammoniacal gas, and are robust, healthy and long-lived. Glue and size boilers, exposed to the most noxious stench, are fresh looking and robust. Tallow chandlers, also exposed to offensive animal odor, attain considerable age. Tanners are remarkably strong, and exempt from consumption. Corn-millers, breathing an atmosphere loaded with flour, are pale and sickly, and very rarely attain old age. Malsters cannot live long, and must leave the trade in middle life. Teamen suffer from the dust, especially of green teas; but this injury is not permanent, Coffeeroasters become asthmatic, and subject to headache and indigestion. Papermakers, when aged, cannot endure the effect of the dust from cutting the rags. The author suggests the use of machinery in this process. In the wet and wear and tear of the mills, they are not seriously affected, but live long. Masons are short-lived, dying generally before 40. They inhale particles of sand and dust, lift heavy weights, and are too often intemperate. Miners die prematurely. Machinemakers seem to suffer only from the dust they inhale, and the consequent bronchial irritation. The (iron) filers are almost all unhealthy men, and remarkably short-lived. Founders (in brass) suffer from the inhalation of the volatilized metal. In the founding of yellow brass in particular, the evolution of oxide of zinc is very great. They seldom reach 40 years. Coppersmiths are considerably affected by the fine scales which rise from the imperfectly volatilized metal, and by the fumes of the spelter, or solder of brass. The men are generally unhealthy, suffering from disorders similar to those of the brass founders. Tinplate workers are subjected to fumes from muriate of ammonia, and sulphureous exhalations from the coke which they burn. These exhalations, however, appear to be annoying rather than injurious, as the men are tolerably healthy, and live to a considerable age. Tinners, also, are subject only to temporary inconvenience from the fumes of the soldering. Plumbers are exposed to the volatilized oxide of lead, which rises during the process of casting. They are sickly in appearance and short-lived. Housepainters are unhealthly, and do not

generally attain full age. Chemists and druggists, in laboratories, are sickly and consumptive. Potters, affected through the pores of the skin, become paralytic, and are remarkably subject to constipation. Hatters, grocers, bakers and chimney sweepers (a droll association) also suffer through the skin; but although the irritation occasions diseases, they are not, except in the last class, fatal. Dyers are healthy and long-lived. Brewers are, as a body, far from healthy. Under a robust and often florid appearance, they conceal chronic diseases of the abdomen, particularly a congested state of the venous system. When these men are accidentally hurt or wounded, they are more liable than other individuals to severe and dangerous effects. Cooks and confectioners are subjected to considerable heat. Our common cooks are more unhealthy than housemaids. Their digestive organs are frequently disordered; they are subject to headache, and their tempers rendered irritable. Glassworkers are healthy. Glassblowers often die suddenly.

Literary occupations do not appear to be more injurious to long life than many others. Many of the first literati, most distinguished for application throughout life, have attained old age, both in modern and ancient times. In the ancient authors, numerous instances of this kind are recorded, many of which may be found collected in the work of Hufeland, already alluded to.—We will add a few instances of extraordinary longevity. The Englishman Parr, who was born in 1483, married when at the age of 120, retained his vigor till 140, and died at the age of 152, from plethora. Harvey, the distinguished discoverer of the circulation of the blood, who dissected him, found no decay of any organ. Henry Jenkins, who died in Yorkshire, in 1670, is, perhaps, the greatest authentic instance of longevity. He lived 169 years. Margaret Foster, a native of Cumberland, England, died in 1771, aged 136; and James Lawrence, a Scotchman, lived 140 years. A Dane, named Drakenberg, died in 1772, in his 147th year; and John Effingham, or Essingham, died in Cornwall, in 1757, aged 144. In 1792, a soldier named Mittelstedt, died at the age of 112. Joseph Surrington, a Norwegian, died at Bergen in 1797, aged 160 years. The St. Petersburg papers announced, in 1830, the death of a man 150 years old, at Moscow; and, in 1831, the death of a man in Russia, 165 years old, was reported. On May 7, 1830, died a man named John Ripkey, at the age of 108, in London. His sight remained good till the last. In 1830, a poor man, near lake Thrasimene, died 123 years old. He preserved his faculties to the last. In

1825, pope Leo XII. gave him a pension. The late return of the population of the city of New York, according to the census of 1830, makes the number of those who live beyond the allotted threescore and ten, in the proportion of about 1 3-5 per cent. of the whole number. Although the number of white males exceeds that of females 1861, yet of those who are upwards of 70, 8009, the excess is in favor of the females, there being 4175 of the latter, and but 3834 of the former. Of the 17 white persons above a hundred, 15, on the contrary, are males; and of the 45 black persons, a hundred and upwards, only 11 are males. The proportion of centenarians among the blacks is much larger than among the whites, making all proper allowances for their exaggeration and ignorance. Belsham's Chronology informs us that 21 persons, who had attained the age of 130 and upwards, died between the years 1760 and 1829: of these, one was aged 166. In the same period, 39 had attained the age of 120, and not 130. The number who attained the age of 110, and not 120, was 36 in the same space. And those who died after the age of 100, and before 110, were 54 within the period. Of the whole number recorded, 94 were natives of England, 23 of Ireland, and 12 of Russia. Doubtless many more have died after the age of 100, without having had their names recorded. The northern climates afford more instances of longevity than the southern; and, although far the greater part of those who have attained extreme old age have been distinguished for sobriety, yet some of them do not appear to have been in the habit of restraining their appetites. In China, where old age is much respected, people receive presents from government, when they have attained a great age.

NUTTALL'S ORNITHOLOGY.

[A Manual of the Ornithology of the United States and of Canada; by THOMAS NUTTALL, A. M. F. L. S. Cambridge, Hilliard and Brown.]

THIS work contains descriptions of all the land birds, natives of the United States and of Canada, fifty-three of which are correctly delineated with beautiful engravings. The work is well executed, and worthy of the consideration of the public. The ornithologist and the less learned lover of nature will find a rare retreat in these vivid descriptions, comprehending the most delightful details of the manners and

customs of the feathered race, all of which arrest the attention very forcibly, and are written with great eloquence.

The following extract from the author's Preface will show his views and resources; and his reputation as a man of science is a guarantee for the faithful performance of his undertaking :

'After so many excellent works have appeared on the Birds of the United States, it may almost appear presumptuous, at present, to attempt any addition to the list. A compendious and scientific treatise on the subject, at a price so reasonable as to permit it to find a place in the hands of general readers, seemed, however, still a desideratum ; and to supply this defect has been a principal object with the author of the present publication.

'Besides exploring the ever fruitful field of nature in this delightful and fascinating kingdom, every available aid has been employed ; and, as might be expected, invaluable assistance has been derived from the labors of the immortal Wilson and of the justly celebrated Audubon. In the scientific part of the Manual, constant recurrence has also been had to the useful labors of C. L. Bonaparte, prince of Musignano, and also to the well known treatise on European Ornithology by the accurate and elaborate Temminck, as well as to other authors of established reputation, such as Brisson, Buffon, Latham, White and Pennant.

'To a number of obliging friends who have assisted him in obtaining specimens, or relations concerning the habits of our birds, the author offers his grateful acknowledgments ; particularly to Charles Pickering, M. D., to whom he is indebted for much valuable information on their geographical limits ; to William Cooper, Esq., well known by his devotion to the study of ornithology ; to Mr. Oakes of Ipswich ; to T. W. Harris, M. D., librarian of Harvard University ; to S. E. Greene, Esq., of Boston ; and to Mr. Nathaniel J. Wyeth, Mr. James Brown, Mr. John Bethune, and Mr. Russell, of Cambridge.'

In our next number we shall favor our readers with an extract from the work, accompanied with a specimen of the engraving.

MISCELLANEOUS INTELLIGENCE.

Cholera.

Westminster Medical Society.

On Saturday evening, November 12, 1831, the Westminster Medical Society's room was much crowded to witness the discussion of the following important question: '*Is cholera contagious or non-contagious?*'

Dr. James Johnson called the attention of the meeting to a letter he had received from Dr. M'Whirter, dated Sunderland, Nov. 7. The writer declared that, after having investigated all the cases of cholera in that town, and consulting with Dr. Duan and other medical gentlemen, they were all convinced that there was not the slightest evidence that the disease had arisen from contagion, or, in other words, was imported. There was one of the nurses in the infirmary affected, and the malady proved fatal; but she was very much afraid of the disease. Another nurse was equally exposed, but not fearing the malady, was not affected. The disease did not differ in any of its symptoms from the worst form of English cholera; and those parts of Sunderland in which it had appeared, were infinitely more crowded and filthy than St. Gile's or Saffron-hill.

Mr. King corroborated the statement of the last speaker, although he (Mr. King) was a contagionist to a certain extent. In such diseases as fevers, small pox, &c. a poison was generated in the system which contaminated the air in the lungs after respiration, and on expiration the air was impure, and, in his opinion, capable of infecting a healthy person, more especially if predisposed to disease, or debilitated. Dr. Sigmond was still of opinion that the cholera was contagious. Mr. Hunt had maturely considered the subject of contagion, both with respect to the cholera and the typhus, and was fully convinced that neither of those diseases were contagious. There was no proof whatever of the contagiousness of cholera, nor that its progress could be arrested by quarantine.

Mr. Searle said that he had been appointed one of the medical officers to the chief hospital of Warsaw. He had been in the hospital while the cholera prevailed, at four o'clock in the morning, and had returned late at night; and sometimes found all the windows firmly closed, and the smell of the rooms very offensive; was often so fatigued as to lie down on

one of the beds; but he never was attacked by the disease. There were forty French physicians, many of them professors, who also observed the malady. They made experiments upon themselves, by inoculation with morbid matter taken after death, and also on pigeons, rabbits, &c.; but in no case was the disease communicated. There were thirty attendants, besides medical men, and only one of them became affected; but he was a most incorrigible drunkard, who was compelled to sleep for two nights on a stone floor, without any covering, by his master, a Polish apothecary. It has been said that the disease was communicated from the Russians to the Poles; but the chief physician of the Polish army has assured him that the origin of the disease was solely referable to a detachment of the army, which was compelled to make a forced march of about fifty miles without halting, and then to encamp in a marshy situation. Next morning fifty of the men had died of cholera. He had also observed the disease for fourteen years in India, and was convinced that it was not contagious, and could not be restrained in its progress by quarantine.

Mr. Gilbert Burnett believed that it was contagious. All contagious diseases, such as typhus, small pox, cholera, were first produced by exhalation or miasma from the earth, and were infectious, and contagious under circumstances of individual predisposition, bad air, filth, &c. There were some persons who did not take such diseases, but still there was no doubt of their contagiousness. It was much better for the board of health to act on the safe side, as they had done, than to use no precaution.

Dr. Granville observed that the contagionists had given up the opinion that the disease was communicated by merchandize, as might be seen by Dr. Barry's last report; and letters were no longer fumigated.

Dr. George Gregory then moved an adjournment, which was carried.

On Saturday, Nov. 19, many of the most eminent surgeons of the metropolis attended.

Dr. Copeland said that two of the Indian boards held cholera to be contagious, while Mr. Jameson, the officer of the third board, contradicted himself, as he was, and was not, a contagionists. He (Dr. C.) was convinced that the Indian cholera, and the prevailing pestilential epidemic were different diseases. The disease which had now traversed many parts of Europe, and was now dreaded so much in this country, was a malady *sui generis*. He had suffered from the dis-

ease in Africa, and had attended those who were afflicted by it, and it by no means resembled the cholera which pervaded Poland, Russia, &c. It was urged at the last meeting, that typhus was not contagious; but this came from persons of small authority, from false prophets, and little reliance could be placed on this argument. In his opinion, the pestilential disease, now misnamed cholera, was as contagious as typhus, scarlatina, small pox, &c.

Dr. George Gregory supported the doctrine of contagion.

Dr. Gilchrist said that he was a non-contagionist in the fullest sense of the word. The disease at Sunderland was the spasmodic cholera of this country, and not a new disease. Why were not the medical men attacked of Sunderland, India, Russia and Poland, if the disease was contagious? The answer was, because medical men did not fear the disease, and were accustomed to contagions. But if the cholera be a new disease, as stated by Dr. Copeland, how, in the name of reason, could medical men be accustomed to it?

Dr. Thompson said a disease might be contagious, and yet not affect such individuals as were not predisposed to it. He was convinced that the cholera was communicable from individual to individual, or through the medium of goods. Its progress had not been arrested by situation, atmosphere, climate, country or season. Had it arisen from the atmosphere, it should be more diffused; if from terrestial emanations, it should have been confined by rivers, lakes, or the sea, which was not the case. It progressed steadily in its course, leaving no *hiatus*, or tract of country untouched, until it had arrived at our shores.

Dr. M'Leod was convinced of the contagiousness of cholera, from its progressing along the course of one of the Russian rivers, and then set running in a parallel direction; and all countries were preserved from its encroachments by quarantine.

Dr. Johnson contended that the cholera of Sunderland agreed in all symptoms with the Indian disease. Some further discussion took place, but no decision was come to. The next subject of debate was announced—'The nature and treatment of cholera.'

Heroism in the Medical Profession.

In the recent accounts of the proceedings respecting the cholera, it appears that several medical men, with the view of ascertaining whether the disease is contagious, have inocu-

lated themselves with the morbid secretion of patients who have died of that disease in the hospitals. Dr. Gregory, in the course of his memorial on the subject of the infirmary, observing upon the zeal of some members of the profession for the advancement of science, states, that 'Those to whom this subject is new, may form some notion of the ardent zeal of some of the votaries of medical science, and may be entertained as well as instructed, when they are informed that many of them have long persisted in trying severe and dangerous experiments on their own persons; that one of them, wishing to ascertain the medical effects of camphor, took, at one dose, such a quantity of it, that his senses failed him, and he was very near dead, and must have died, in good earnest, but for the lucky accident of the physician, who was called to his assistance when he was speechless, casting his eyes on the papers which lay on his patient's table, and which contained an account of the experiments he had been trying; that one of the most eminent surgeons that this age or country had produced, deliberately inoculated himself, by means of a lancet dipped in the matter of a foul disease, and kept himself thoroughly tainted with it for about three years, that he might have the satisfaction of observing the regular progress of it through every part of his body; that another very ingenious man of our profession, in order to ascertain the effects of different kinds of food on the human body, lived for two months or more on bread and water—then, for some time on roast goose—then, on suet—then, on sugar—and, at last, fairly died on Cheshire cheese. But hundreds or thousands of experiments, more or less severe or dangerous, have been tried by physicians and surgeons on their own bodies, without the least necessity, and purely from their zeal for the science.'

To make Sealing Wax.

Those who use large quantities of sealing wax may find it economical to make it, which is very easy. Take equal weight of gum lac, vermillion and pure Venice turpentine. Melt them over a gentle heat, and stir them well together. Take a detached portion of the mass and roll it with the hand upon a plate of copper slightly heated; or rather it may be cast in a mould made on purpose, of plaster, of horn, or of copper. Instead of vermillion, other colors may be used, according to the tint which it is desired that the wax may have.

Jour. de Connois, &c.

The Eagle and the Weasel.

A group of haymakers, in Selkirkshire, saw an eagle rising above the steep mountains that enclose the narrow valley. The spectators were soon aware of something peculiar in the flight of the bird they were observing. He used his wings violently, and the strokes were often repeated, as if he was unusually agitated, wheeling in circles constantly decreasing, while his ascent was proportionally rapid. He rose until he was nearly out of sight, when at length he appeared to descend, and with great rapidity, but in the manner of a shot bird. When he reached the ground, a black-tailed weasel came from the body, as the haymakers came up, looked around, stood on its hind legs for a moment or two, and then ran into a bush. The eagle was dead, covered with his blood ; upon examination it appeared the weasel had eaten into his throat and destroyed him.—*Mag. Nat. Hist.*

Winter Quarters of Frogs.

In draining a bog, or springy piece of ground in the winter, (during the frost,) I discovered a large quantity,—some hundreds, I suppose,—(frogs,) imbedded about three feet below the surface, in the head or source of a more than usually strong spring. Upon being uncovered, they appeared very inactive, but not torpid or motionless, and attempted to bury themselves again in the sand, which, from the flowing of the water, was so easily separated as to admit a pole of considerable length to be run down it with a slight pressure. The cavity in which they were, and which apparently was formed by them, was so placed that the water of the spring flowed through it, and prevented their feeling the effects of the frost. In cleaning ditches or stagnant ponds during the winter, I have never seen any but at the bottom of ponds, in which, I am told, they are common. Are we not to infer from this, that they instinctively seek springs, as the water is less liable to freeze ? and as they were in the instance mentioned, capable of moving, that they do not hybernate, or become torpid during the winter, but that they respire in water, or in their hiding places? I have never observed them in ditches or pools, until near their spawning time, viz. after a few warm days in February or March, when their "croaking" is considered the precursor of spring, and provocative of sport to "boys;" after which the embryo frogs appear as black spots in a large mass of gelatinous matter.—*Mag. Nat. Hist.*

METEOROLOGICAL JOURNAL,

Kept at Boston, for December, 1831.

Day.	THERMOMETER. Morn.	Noon.	Even.	BAROMETER. Morn.	Noon.	Even.	FACES OF THE SKY. Morn.	Noon.	Even.	DIRECTION OF WINDS. Morn.	Noon.	Even.	RAIN. Inch.
1	22	25	17	29.74	29.82	29.94	Snow	Fair	Fair	N. W.	N. W.	N. W.	0.06
2	10	19	15	30.05	30.04	30.00	Fair	Fair	Fair	N. W.	N. W.	N. W.	
3	14	18	17	29.93	29.82	29.77	Snow	Cloudy	Snow	N. W.	N. W.	N. E.	0.05
4	17	21	17	29.66	29.52	29.38	Snow	Snow	Cloudy	N. E.	N. E.	N. E.	1.07
5	18	21	15	29.31	29.60	29.82	Cloudy	Fair	Fair	N. E.	N. W.	N. W.	
6	10	25	15	30.03	30.05	30.08	Fair	Fair	Fair	N. W.	N. W.	N. W.	
7	10	25	20	30.11	30.09	30.08	Fair	Fair	Fair	N. W.	N. W.	N. W.	
8	7	25	13	30.13	30.09	30.12	Fair	Fair	Fair	N. W.	N. W.	N. W.	
9	20	30	15	30.13	30.02	30.02	Cloudy	Cloudy	Fair	N. W.	N. W.	N. W.	
10	8	26	12	30.38	30.41	30.43	Fair	Fair	Fair	N. W.	N. W.	N. W.	
11	5	32	27	30.35	30.33	30.20	Fair	Fair	Fair	S. W.	S. W.	S. W.	
12	17	24	12	30.16	30.14	30.18	Fair	Cloudy	Fair	N. W.	N. W.	N. W.	
13	7	19	11	30.00	30.00	30.10	Cloudy	Fair	Fair	S. W.	W.	N. W.	
14	9	20	15	30.29	30.34	30.34	Fair	Fair	Cloudy	S. W.	N. W.	N. W.	
15	12	18	7	30.31	30.22	30.22	Snow	Fair	Fair	N.	N. W.	N. W.	0.15
16	5	22	26	30.08	29.82	29.62	Cloudy	Cloudy	Cloudy	S. W.	S. W.	S. W.	
17	26	26	10	29.16	29.11	29.50	Snow	Fair	Fair	S. W.	N. W.	N. W.	0.08
18	1	12	9	29.90	30.00	30.14	Fair	Fair	Fair	W.	W.	N. W.	
19	12	24	15	30.00	29.85	29.92	Cloudy	Fair	Fair	S. E.	S. W.	W.	
20	11	25	24	30.06	30.00	29.82	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
21	24	33	20	29.50	29.35	29.55	Cloudy	Cloudy	Fair	S. W.	S. W.	S. W.	
22	4	5	—1	29.96	30.06	30.15	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	2	18	12	30.40	30.40	30.20	Fair	Fair	Fair	W.	W.	S. W.	
24	26	36	34	29.88	29.44	29.55	Cloudy	Rain	Fair	S. W.	S. W.	S. W.	1.08
25	30	32	30	29.90	29.90	29.82	Fair	Fair	Fair	N. W.	N. W.	N. W.	
26	18	25	17	29.76	29.67	29.66	Snow	Fair	Fair	N. W.	N. W.	N. W.	0.02
27	21	25	15	29.66	29.71	29.78	Cloudy	Cloudy	Fair	S. W.	S. W.	N. W.	
28	9	28	24	29.80	29.62	29.51	Cloudy	Cloudy	Snow	N. W.	N. E.	N. E.	0.76
29	23	27	23	29.53	29.51	29.56	Snow	Cloudy	Snow	N. W.	N. W.	N. E.	0.87
30	18	21	13	29.70	29.80	29.95	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	
31	3	28	25	30.10	30.06	29.86	Fair	Cloudy	Snow	W.	S. W.	S. E.	0.06

Depth of water fallen, 4.2 inches.

At Washington, on the morning of the 16th, the thermometer was 6 degrees *below* zero, and at Nashville, which is in the latitude of Raleigh, 16 *below*, or 21 degrees lower than at Boston.

Pendleton's Lithog.y Boston.

THE NATURALIST.

MARCH, 1832.

CONCHOLOGY.

NO. I.

The term Conchology is derived from the Latin *concha*, a shell or shell fish, and Greek *logos*, discourse, and comprehends that branch of natural history which treats of shells, distributes them into genera and species, and describes the character and economy of the animals which inhabit them.

To some, the examination of this department of science has appeared useless, and unworthy to occupy the time and talent of an informed mind. Reasoning with persons of this description, is seldom attended with any good effect. Ignorant of the advantages which have resulted to mankind from an intimate acquaintance with natural objects, they overlook the steps by which they have been gained: and likewise seem to forget, that the examination of those objects which an all-perfect Being has created, can never be degrading to man, who was sent into this world in order to examine, admire and adore.

Besides, if we attend to the variety of forms which shells exhibit, and to the richness of their coloring, we will not be surprised that they have obtained a conspicuous place in public collections, and have attracted the notice of the curious observer. But to view shells merely as objects of beauty, without attending to the animals of which they only form a part, would be to overlook by far the most important branch of the science; and, like the florist, to take notice of color and shape, and neglect to attend to those functions which, while they excite our astonishment, exhibit marks of design. The examination of the contained inhabitants, enlarges our knowledge of the laws of animal life, and teaches us that each shell, however insignificant it may seem to be, possesses

faculties suited to the supply of its wants, and to the situation which it is destined to occupy. Or in the more harmonious periods of the poet, we would say,

> 'Each shell, each crawling insect holds a rank
> Important, in the plan of Him who framed
> This scale of beings.'

But we are not disposed to rest the claims of the science of conchology to public favor, altogether on the grounds which we have now stated. As objects of utility to man, shells deserve our notice. Many species supply his table with agreeable and nutritious dishes ; others form most enticing baits for catching fishes, or furnish materials for the manufacture of different kinds of dress. The pearl is prized as an ornament, and the Tyrian purple is deservedly held in estimation.

We must view shells likewise as the enemies of man, and entitled to his consideration. Some are deleterious to his constitution, while others defeat his plans. The barnacle, by adhering to the bottoms of ships, impedes their motion ; and the teredo pierces their planks and destroys them.

When these circumstances are duly considered, the science of conchology will appear of importance, as it unfolds the history of objects of beauty, curiosity and utility.

Of late years, the study of conchology has been pursued with eagerness by the most eminent naturalists. Under these auspices, the science has assumed a consistent and regular form. And the *Boudoir* of the accomplished female would be considered as unfurnished, were it not decorated with these favorite objects of admiration. Indeed, in this respect, mankind have discovered no small degree of folly and extravagance, in the high price which has been given for rare and beautiful shells, and often only on account of their rarity.

The few scattered fragments concerning the natural history of shells, or testaceous animals, which are to be found in the writings of the ancients, when compared with the more extended and systematic labors of the moderns, are so unimportant and inaccurate, that it would be altogether superfluous to trouble our readers with an account of the information which they contain. It appears however from the works of Aristótle and Pliny, the great naturalists of Greece and Rome, that the study of conchology was not entirely neglected in their time. It appears, too, that admirers and collectors of shells were not then wanting. Scipio and Lælius, we are informed, found a relaxation from the toils and care of war and government, by indulging in this elegant amusement.

Nor will it be attended with much advantage, to give a particular account of the works of the earlier writers on this subject among the moderns. These are Gesner, Johnston, Rondeletius, Aldrovandus, Bellonius, Wormius, and some other authors, who cultivated this department of natural history, and accompanied their descriptions with figures, illustrative of the objects which they described. The first author who attempted a systematic division of shells, according to their external form and character, was John Daniel Major, professor of medicine in the university of Kiel in Holstein. His method is published at the end of his curious and interesting remarks on the treatise concerning the *purpura* of Fabius Columna, printed at Kiel in 1675. The system of the German naturalists was followed by that of Dr. Lister of England, on a more extended and improved plan, which was published ten years after. Succeeding naturalists turned their attention to the study of conchology, and to the improvement of the classification of the numerous objects of this department of natural history. Such were Buonanni, Rumsius, Langius, Breynius, Tournefort, Gaultieri, D'Argenville, Klein, Linnæus, Adanson, Geoffroy, Muller, La Marck, De Blainville, Schumacher and Cuvier.

To exhibit all the systems of these authors would require volumes, and therefore cannot be expected in the limited space which our pages are destined to occupy. Our only object is at present to give such a view of the subject as will tend to facilitate our progress in the study of conchology. We shall here treat of the general terms which are employed in describing shells, and the names by which the different parts have been distinguished by naturalists. This, we trust, will not be unacceptable to our readers, particularly those to whom works on this subject are inaccessible without imposing upon them a greater expense than they can afford, or of which they may deem the subject worthy.

All shells or testaceous bodies hitherto discovered, may be divided into three principal tribes, and which, after the Linnæan manner, may be denominated *Multivalve, Bivalve* and *Univalve.*

An external part of a shell being of a testaceous substance, and either itself forming a shield or covering for the animal, as in univalves, or in union with another, or others connected by a ligament, cartilage, hinge, teeth, or other fastening, is denominated a valve. The shells, therefore, consisting of a single piece, are called univalves, those of two parts bivalves, and those of many parts multivalves. Between bivalve and

multivalve no distinction is drawn ; shells consisting of more than two such parts, being called multivalve, without any regard to number. An amendment is proposed by some of the French writers, in a new order under the name of trivalve.

Shells of the simplest form are arranged by some naturalists in the first class, from which they proceed progressively to those possessing the greatest number of valves, and being of the most intricate structure. This is an ancient and very simple mode of arrangement, and has its advocates in the present day. Linnæus reverses this order by beginning with multivalve shells, which are of the most complex structure, and ending with those of the simplest form. We cannot avoid thinking the former preferable, and shall adopt it in the present instance.

Explanation of the Parts of Shells.

Univalves. In the examination of a shell of this order, the contour or outline is the first thing to be regarded. By this the conchologist is guided in his deffinition of simple, spiral, or turbinated shells ; discoid, flattened, or turrited shells ; those with smooth or uneven *anfractus ;* the ventricose, alated, labiated, rostrated, and many other distinctions, all which strike the eye at the first view. It is indeed, by attending to the contour, that the principal distinctions in shells of this kind are at once perceived, taking into consideration the back and front profile at the same time.

Next to the profile of the shell, the structure of the mouth, the pillar, and expansion of the inner lip, the gutter or canaliculation, and the umbilical opening, and operculum if any, are to be considered, and lastly, the work on the outer surface, as well as the colors with which it is embellished.

The base or bottom of the shell we consider that part upon which it rests when supported in an erect position, with the summit or tip of the spire standing vertically. In such shells the tip is called the apex. The course of the spires or wreaths is from the left to right in most spiral shells. When speaking of the right and left sides of a shell, it should be understood as having the aperture downwards, and it will then be seen that in most shells the aperture or opening is on the left side, that is, facing the right hand of the spectator.

Base, the tip of the salient end of the shell, at the extremity opposite the apex of the spire ; in the rostrated kind of univalves it implies the tip of the beak. Some say the shell rests on its base when laid upon a flat surface with the mouth downwards ; this is not correct, except in the patella tribe,

and some other univalves which have no regular spire. The base of a shell is denoted in plate iii. fig. 1, by *a*.

Apex, the summit of the shell, *b*.

Front, the face of the shell, with the aperture placed directly in front of the observer, *c*.

Back, that part of the shell which is immediately opposite to the preceding.

Sides, those parts seen longitudinally in profile, to the right and left when the shell is viewed either in a front or back position, *d*.

Body of the shell, (*corpus*) the first whorl of the spire at the base, fig. 2, *e*.

Whorl, denotes one of the wreaths, turns or volutions of the shell, fig. 3, *f*.

Spire, comprehends in a general sense, all the whorls of the shell, the first or body wreath excepted, fig. 1, *g*.

Crown of the spire, fig. 4, *c*.

Suture of the spire or *whorls*, is the spiral line which separates the whorls, and which is sometimes sulcated, crenulated or somewhat projecting, fig. 1, *h*.

Pillar or *columella*, is the inner part of the left lip or column, which runs through the shell, from the lower extremity to the tip of the spire, and from which all the spires take their origin; the columella being situated as nearly as possible in the axis of the shell, and serving as its basis and support throughout. It is generally either flat, grooved, folded or truncated in that part which is visible at the opening, fig. 4, *i*.

Aperture, called in familiar language, the mouth of the shell, is the entrance to the chamber in which the animal resides, and is applicable to the openings of univalve and multivalve shells. The aperture is either entirely open, or closed by the operculum attached to the body of the animal, when the animal retires into its dwelling. This aperture varies in form in different shells, being angular, rounded, semi-lunar, linear or otherwise, and sometimes appear double, the inner margin being surrounded by an exterior one, fig. 2, *m*.

Lip, the expansion of the exterior part of the aperture constitutes the lip in labiated shells, and the wing in the alated kinds, fig. 4, *l*.

Beak or rostrum, is that part at the base which extends in a strait or slightly oblique direction from the bottom of the aperture, and is larger or smaller in different families, fig. 3, *n*.

Canal or gutter, an elongation of the aperture of the shell descending in a groove or gutter-like process. Some kinds of rostrated shells have the canal remarkably conspicuous, form-

ing a sinus from the aperture throughout the whole length of the beak, fig. 3, *o.*

Umbilicus is the opening or perforation in the lower part of the body, or first whorl of many spiral univalves, and is very conspicuous in a number of the trochus and nerita genus in particular. This umbilical preforation runs in a straight line from the base to the summit of the shell, forming throughout a spiral groove or gutter, which is wide at the entrance and tapers gradually towards the apex. This opening occurs in many shells at the base of the pillar, fig. 2, *u.* A shell without an umbilicus is termed imperforate; sometimes the term imperforate implies that it has neither umbilicus, nor canaliculation at the base.

Operculum is a testaceous or cartilaginous appendage, peculiar in a considerable degree to the univalve tribe of shells, and those only of the spiral or turbinated kinds. This appendage is not connected with the shell, but the animal; and serves like a lid or little door, to protect or close up the aperture of the chamber when the creature retires within its habitation.

Bivalves. These consist of two valves united by means of a cartilage, hinge, connection of the teeth or other process. In order to constitute a bivalve shell, it is only requisite that it be furnished with two connected valves without regard to their resemblance in form or dimensions. Some of the bivalves have both valves formed alike; in others they differ only in a slight degree, and again in others they are altogether dissimilar. Shells having both valves alike are called equivalves. Equilateral valves imply those which have both sides of the same valve alike, as for instance, when a longitudinal line is drawn from the beak to the opposite margin, the space on each side of the line is distinguished by the appellation of the right and left side; and when the form of both of those spaces correspond, the shell is equilateral: the inequilateral valves are the reverse of this, a line drawn as above described, from the beak to the opposite margin, presenting two sides of a very different shape. Sub-equilateral shells, are those having the valves nearly equal at both sides.

All bivalve shells do not completely close their shells; while others, when the shells are shut as closely as their form will allow, still exhibit a kind of hiatus, or gaping, either at the anterior or posterior end, or at both; and in some, when the valves are shut, both the anterior and posterior parts are closed, but an opening appears on one side of the beak.

One of the first circumstances to be considered is, which part of a bivalve shell ought to be deemed the base, because

when this is determined, every other part will fall progressively in their relative order under our observation. We name that part of the margin or limb which is situated in a direct line opposite the beak, the base of the shell.

Base of the bivalve shells, exemplified in *Venus verrucosa*, fig. 5, *v*.

Summit, a word applied in a general manner to the top or most elevated part of the two protuberances observable in the greater number of bivalves, fig. 5, *s*.

Beak, the pointed termination, apex, or tip of the protuberances last mentioned, and which, in many shells, turn spirally downwards, or obliquely, so that the beak itself is seldom the most elevated part of the shell.

Sides, the lateral parts of the valves distinguished by the epithets of right and left sides; in common language, the two valves of a shell are called the sides, but it is not understood as a term in conchology in this view, fig. 5, *x*, *z*.

Margin or *limb*, the whole circumference or outline of the shell, when laid flat down on one valve.

Disk, the convex centre of each valve or exterior surface, fig. 6, *d*.

Anterior slope, that part of the shell in which the ligament is situated; in the front view of the anterior slope, the beak falls back or behind, fig. 6, *e*.

Posterior slope, that immediately opposed to the former, and in which the beaks of the shell turn forward, fig. 6, *c*.

Lunule, the lunulated depressions below the beaks, either on the anterior or posterior slope, and sometimes on both; they may be distinguished under the appellation of anterior or posterior lunules, according to the slope in which they are situated, fig. 7, *a*, *b*.

Cartilage of the lungs, called also the ligament of the hinge, the substance of a flexible, fibrous and somewhat horny nature, by means of which the two valves are united near the beak, fig. 8, *c*.

Inside of the valve, exhibits the concave surface, fig. 7, *i*.

Ears, the lateral processes near the beaks, as in the scallop tribe: those occur either on one side, or on both, fig. 9, *e*, *e*.

Length and breadth of the shell. The length is measured from the cartilage or beak to the margin below; the breadth is of course taken in the opposite direction. The breadth of many bivalve shells exceed their length: some remarkable instances of which occur in the solen tribe, fig. 8, *a*, *a*, length; *b*, *b*, breadth.

Hinge, the point of union between the two valves, formed by the connection or articulation of the teeth in both valves, or by the teeth in one valve fitting into hollows or sockets in the valve opposite, fig. 8, *h*.

Byssus, the appendage called the beard; by means of which some bivalves fasten themselves to the rocks.

Multivalves. The shells of this order are few, compared with either of the preceding; and the terms proposed for those, are applicable for the most part to the multivalves. The following require more explicit mention.

Base, that part of the shell upon which it rests: in the lepas tribe it implies the part immediately seated upon the stem or pedicle; in the balani, the base is generally larger than the summit, and is the bottom by means of which the shell is fixed upon the rocks or other extraneous bodies, fig. 10, *a*.

Ligament, the substance, whether membranaceous or tendinous, which serves to connect the valves together. The connection of the valves in some multivalves is formed by the parts of one valve locking into another, fig. 11, *v*, *v*.

Operculum. The balani have the aperture at the summit closed by means of four small pieces of valves, which are commonly called the operculum; these opercula of the balani are, however, very different from those of univalve shells, fig. 10, *o*.

Such are the general terms applied to the parts of shells.

The animals which inhabit shells are classed in the grand division Mollusca of Cuvier. In this division the sentient principle is lodged in a number of medullary masses, dispersed in different parts of a soft body. And though the medullary masses are not always united by nervous filaments, the organs of sense and motion are arranged more or less on two sides of a nervous axis or longitudinal series of medullary masses.

The principal medullary mass is situated upon the throat. The circulatory system is considerably complicated; much more so than that of the articulated division. The blood is dark-colored or blue. Fibrin appears more abundant than in vertebral animals. Their muscles are attached to many parts of the skin, forming a tissue more or less complicated and compact. By various contractions and elongations they move, swim, and perform other motions. They have considerable irritability; the naked skin is very sensible and furnished with a liquid humor which issues from its pores.

Molluscous animals are likewise arranged into classes, orders, genera, species and varieties, a full account of which cannot be given in the small extent allotted to this work.

To those who wish to make conchology a study, we can only recommend them some of the late works of the authors heretofore enumerated.

Having given the general terms applied to the parts of shells, we next purpose to inquire what is the nature of their substance, and in what way it is produced by the animal, and how it is enlarged as the animal increases in size. These topics shall be the subject of these essays, which may be conveniently divided into the following sections. 1. Of the constituent parts of shells. 2. Of their formation. 3. Of the colors of shells. 4. Of the formation of the umbilicus and protuberances, &c. 5. Of the pearl and pearl fishery.

ORNITHOLOGY.

NO. III.

Eggs of birds. By experiment it appears that birds do not instinctively know the necessary time of incubation; for unincubated eggs of a bird have repeatedly been taken and placed under another of the same species, which was on the point of hatching, and *vice versa*, those on the point of hatching into the nest of such as had only began to sit; and in both cases the young were brought to maturity. Birds will sometimes discriminate the egg of another species put into their nest, and will turn it out; but they will frequently breed up the young of another when exchanged, provided they are of the same age, and not very large when the experiment is made.

Those who suppose a bird capable of producing eggs at will, or that any bird is excited to lay more eggs than usual by daily robbing their nest, are certainly mistaken. In a domesticated fowl it is probable the desire of incubation may be prolonged by leaving a little or nothing in the nest to sit on. It will therefore lay the number allotted by nature, which is determined before the first egg is produced. If it is prevented from incubation by any means whatever, it may begin again to lay in five or six days; but there is always an interval of a few days, and sometimes as many weeks, which must wholly depend on the age and vigor of the bird. When it happens that a fresh lot of eggs is laid with only a few days' interval, and that perhaps in the same nest, it is deemed a continuation for want of nice observation; but we are not to look to domesticated animals for natural causes, for those are taken from

their state of nature. Let us look to the birds in their natural wild state, and see if any well-attested instances are to be found where they have laid more eggs successively, by taking one from the nest daily. For instance, the number laid by the robin is commonly five, sometimes only three or four, and rarely six; will the taking away the daily-laid egg produce the seventh or eight? No: we believe there never was an instance. A bird will only lay the usual number peculiar to the species; and if, at the period of incubation, it perceives the nest emptied, it is deserted. The link of nature having been broken, the female stimulates to love again, and soon brings forward by that stimulus, aided by the male fecundity a new lot of eggs; never more than the former, and usually less, because this is a forced production, at the additional expense of the vigor of the bird, and loss of animal parts, which is the cause of a great variation as to the number of eggs laid by domestic fowls, depending entirely on the strength of the constitution and the nourishment of the food. In all animals taken immediately under the care of man, the dictates of nature are partly suppressed, their food changed, habits and manners altered, and disease often ensues, which is the origin of the great variety of colors in reclaimed animals.

Nature pursues invariably one course; therefore to draw a general rule of her actions we must strictly adhere to her in an unmolested, uncultivated state; for if we deviate from that we must infallibly err. We do not mean to say accidental varieties do not take place in animals unreclaimed, but such *lusus* are by no means common; and when we see a bird materially deviate in color from its species, we may consider it as a constitutional defect, that the natural secretions are changed or suppressed with which the feathers are dyed. To enter minutely into a discussion on this head would swell this article beyond its limits; all we wish is, to point out the necessity of strictly adhering to nature for observations on natural causes. A domestic fowl which will sit for six weeks upon an empty nest, is not to be produced as a proof of the actions of nature. Will any bird, in its natural wild state, continue to sit on its nest after the eggs are taken out? One egg, indeed, is sometimes sufficient to produce the act of incubation; but what is it then that prevents the secondary egg from coming forward, when it is well known if a bird is prevented from setting, she soon resumes her desire of propagation natural to every animated being? Because the very act of incubation is the effective cause; the line

which nature has drawn, and which the animal by instinct feels. We conceive the production of a second lot of eggs to be an extraordinary exertion of nature; a wonderful proof of the affection of the all-wise Creator for the preservation and continuation of his creatures, and the resources he has furnished some animals with, in case of necessity, to prevent the total extinction of the species. It is but few birds, if any, that would produce a second lot of eggs in the same season if unmolested; but if their nests are destroyed, it is probable three or four separate lots may be protruded.

We have never been able to discover in the earliest breeders of birds, the production of a second brood after the first has been brought to maturity. Their attention to their young continues long after they leave the nest. The great exertion to collect food for so many must exhaust the animal spirits, to recruit which is a work of time; so that the season is too far advanced for a second production. The secondary eggs being brought forward is not effected by the will of the bird, but is caused by the dictates of nature, the impulse of love.

The extraordinary and rapid growth is also worthy of notice. We before observed, there is a line drawn by nature to prevent more than a certain quantity of eggs, peculiar to each species, being fecundated at once; otherwise a bird in one season might produce all the eggs she possessed, and afterwards become useless in propagation.

But notwithstanding only a portion of the *ovaries* are impregnated at the same time, yet the stimulus to love considerably increases the size of all the eggs of the *ovarium*. When the stimulus ceases, be it from what cause it may, the organic particles excite love by distending those parts necessary for production; so, on the contrary, the want of a sufficient quantity reduces them to their primitive state. It seems absolutely necessary that a dilation of the *ovaries* should take place before they can be fecundated; and that, by the law of nature, only a certain number should be sufficiently large to be impregnated at the same time; and that no others can possibly receive the male stimulus till after the first set are produced. A superabundance of organic particles is cause sufficient to separate an egg from the *ovarium* without male contact. It is possible a bird, in its natural state, may lay an egg unimpregnated, which may account for addled eggs being found in nests. Birds have been found sitting on eggs perfectly dried up. This also seems to prove that birds do not know the necessary time of incubation.

Immediately under the shell, lies that common membrane or skin, which lines it on the inside, adhering closely to it every where, except at the broad end, where a little cavity is left, that is filled with air; which increases as the animal grows larger. Under this membrane are contained *two whites*, though seeming to us to be only *one;* each wrapped up in a membrane of its own, one white within the other. They differ from each other in specific gravity. In the midst of all is the *yolk*, wrapt round likewise with its own membrane. At each end of this are two ligaments, called *chalazæ*, which are white, dense substances, made from the membranes, and serving to keep the white and the yolk in their places. They are called chalazæ from their resemblance to hail.

The *cicatricula* is the part where the animal first begins to show signs of life; it resembles a vetch or small pea lying on one side of the yolk and within its membranes. The outer membranes and ligaments preserve the fluids in their proper places, the white serves as nourishment; and the yolk with its membranes after a time, becomes a part of the bird's body.

The growth of an egg after impregnation is exceedingly rapid; the yolk only is formed in the *ovarium*, where it remains till within twenty-four hours of being produced; when that part is fully matured, it separates and falls down the *oviduct* into the *uterus*, where the egg is perfectly formed; first the *vitellus* or yolk is surrounded by the *albumen* or white; and lastly is covered with a calcareous shell. The very expeditious growth of these last, appear to be an extraordinary exertion of nature. The calcareous covering of an egg is concreted and formed in a most expeditious manner; a few hours only seem necessary for this work. Only one *vitellus* separates from the *ovarium* at a time, (except as we shall hereafter mention,) till the exclusion of which no other succeeds. But as this is a daily production, with few exceptions, there is no more time allowed for perfecting the *albumen* and shell than twenty-four hours.

As the course of nature is obstructed by remote causes, there are few general rules without some exceptions; but an individual deviation by no means perverts the law of nature, but is simply an individual defect. We shall here instance imperfect eggs sometimes produced, such as want the *vitellus*,* and others containing two yolks; and although

* The *centininum Ovum* of naturalists, vulgarly called a cock's egg. This name has been given to it from a supposition that it was the 100th egg, or the last the bird could lay.

there are probably very few instances of such productions from birds in their wild state, yet it is no uncommon thing in domestic fowls.

We are also told of eggs with double shells; and we frequently see eggs without any calcareous covering, but wrapped in a soft pliable skin like vellum.

To account for these extraordinary productions, we must conceive a defect exists at the time in some part of the animal body; and as the *vitellus* and *albumen* derive their origin from different parts, it is natural to conclude, in those preternatural eggs destitute of yolk, the cause proceeds from some defect in the *ovarium*. May it not be occasioned by an unequal stimulus in the parts necessary to perfect the egg, and that the growth of the *vitellus* is not in proportion to the *albumen*? Thus while the vesicles appointed for collecting, preparing and uniting the organic particles of the *albumen* in the *uterus* have all their effective powers, those of the *ovarium* are weak; of course the one goes on with the operations appointed by nature, while the other is stopped in its progress for want of a sufficient quantity of organic matter to bring it to perfection at the same time. Hence the reason of the common fowls sometimes producing three or four imperfect eggs following, by which the *vitellus* becomes sufficiently large, and a regular succession of perfect eggs are produced. On the contrary, when, from the same causes, the growth of the *vitellus* in the *ovarium* is too luxuriant, two yolks pass the oviduct together, which being surrounded with the usual quantity of the *albumen*, is brought forth in the form of a single egg of an extraordinary size. From these it is possible that twins are produced, but more frequently deformities, which are seldom hatched.

Color of Eggs. It was a notion of Darwin's that the variety in the colors of eggs, as well as in the colors of many animals, is adapted to the purposes of concealment from their natural enemies. Thus, he remarks that the eggs of the hedge chanter are greenish blue, as are those of crows, which are seen from beneath in wicker nests, between the eye and the blue of the firmament. M. Gloger, a German naturalist, has followed up this singular theory into some detail, and considers it to be a remarkable provision of nature, that birds whose nests are most exposed, and whose eggs are most open to the view of their enemies, lay eggs of which the color is the least distinguishable from that of surrounding objects, so as to deceive the eye of birds, or of other plundering animals; while birds, the eggs of which have a bright decided color,

and are consequently very conspicuous, either conceal their nests in hollows, or only quit their eggs during the night, or begin to sit immediately. It is also to be remarked, that in the species of which the nest is open, and the female brings up the brood without the assistance of the male, these females are generally of a different color from the male, less conspicuous, and more in harmony with the objects around. The foresight of nature, has, therefore, provided for the preservation of the species of which the nest is altogether exposed, by imparting to the eggs a color which will not betray them at a distance; while she could, without inconvenience, give the brightest color under circumstances where the eggs are concealed from view. Or, perhaps, to speak more correctly, numerous birds can deposit their eggs in places accessible to view, because the color of the eggs make them become confounded with the surrounding objects; while other birds are obliged to conceal their nests, because the conspicuous color of the eggs would have attracted their enemies. Let the explanation, however, be what it may, the fact exists, and M. Gloger, who has examined all the birds of Germany, is said to have satisfactorily provèd it. Eggs then must be distributed into two series, according as their color is simple or mixed. The simple colors, such as white, blue, green, yellow, are the brightest, and consequently the most dangerous for the eggs. The pure white, the most treacherous of colors, is found among birds which breed in hollow places, like the woodpeckers, the kingfisher, the swallow and the martins. It is only among such birds that the eggs are of a remarkable whiteness. The eggs are also white among some species, which, like the marsh wren, construct their nests with such narrow openings, that the eye of their enemies cannot penetrate within. White eggs are also found with birds that quit them only during the night, or at least very late in the day, such as the owls and falcons. Lastly, this color is found among birds which lay only one or two eggs, and sit immediately after, like pigeons. As to the bright green or blue color, it is found to belong to many species which make their nests in hollows, like the blue bird. In the second place, this color is common to the eggs of birds, the nests of which are constructed of green moss, or placed at least in the midst of grass, but always well-concealed; such for example as Wilson's thrush. Lastly, green eggs are met with among many strong birds able to defend themselves against plunderers, like the herons. A bright green color, verging towards a yellowish tint, is found among the eggs of many birds which

lay among the grass, without making a finished nest, which soon disappears beneath the quantity of eggs. The same color is also remarked among several birds, which quit their eggs when they lay them, but which are attentive in watching them, as swans, ducks and geese. The eggs of certain great birds which make their nests in the open air, but are well able to defend themselves, are a dirty white, as may be observed among the vultures and eagles. Among the eggs of a mixed color, they are to be distinguished which have a white ground, and those of which the ground differs from white. Most of the eggs with a white ground are concealed in well covered nests.

With all due deference, however, to M. Gloger, we would remark that the theory appears to us much more beautiful and ingenious than true; for we could enumerate more instances in which the principle fails than holds good. If we admit that the brightest white eggs are to be found in birds whose nests are the most concealed, may we not rather infer that, because the interior of these nests is peculiarly dark, the bright white color is convenient to the bird, to enable her to distinguish them? At all events, we must regard M. Gloger's hypothesis as ingenious, rather than supported by facts.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. III.

Culture of the Mulberry. 'The first object of attention, preparatory to any extensive attempt for the production of silk, must be the culture of the mulberry tree, the leaves of which form the sole subsistence of the silk worm.

'This tree, the *Morus* of botanists, is a genus of the tertrandria order, belonging to the monœcia class of plants. Linnæus enumerates seven distinct species of the mulberry tree.

'The *Nigra*, or black-fruited species, is well known in this country, and much prized for the fruit which it so abundantly bears. Any particular description of it here would be superfluous.

'The *Alba*, or white-fruited mulberry, differs from the nigra in having its stem straighter, and its bark smoother, and of a lighter color. Its leaves are likewise smoother, thinner, much

smaller, and of a lighter green. The fruit, which is of a pale gray color, is small, of a vapid sweetness, and of no value.

'The *Rubra*, or red Virginia mulberry tree, differs but little from the alba, except in the red color of its fruit.

'The *Tartarica*, or Tartarian species, abounds on the banks of the Volga and the Tanais.

'The *Papyfera*, or paper mulberry, differs from the other species in having palmated leaves. From the bark of its branches the Japanese prepare their paper. Its leaves are also used as food for the silk worm, for which purpose the tree is now successfully cultivated in France.

'The two remaining species, the Tinctoria and Indica, are not used for the nourishment of the silk worm.*

'The mulberry tree is hardy, of quick growth, and easily naturalized in all climates. The black species has always been cultivated for its fruit in Europe. The white sort comes from India, whence it has been introduced into all those western countries which have attempted the culture of silk.

'The respective qualities of the different species, as connected with the silk worm, cannot be better pointed out than by observing, that if leaves of the white, the red, and the black mulberry be given at the same time to the insect, it will eat first the white, next the red, and lastly the black, in the order of the tenderness of the leaves. The Tartarian seems to hold as high a place in its esteem as either the red or black kind: all, however, give place to the white, which, as it came originally from China, would appear to be its most natural food.

'Most writers on the subject affirm that the white mulberry is always used in China, while some few assert that the Chinese now feed their silk worms on the Tartarian species.

'The white sort is generally planted for this purpose in Europe, its leaves being more eagerly desired by the worms. The trees of this species likewise possess the advantage of coming into leaf a fortnight earlier than the black, for which reason the eggs may be hatched earlier in the spring, and the cares of rearing the insects are not prolonged too far in the hottest season. The white mulberry tree is likewise of quicker growth, is not so much injured by the constant picking of its leaves, nor is it, like the black, incommoded by a

* Besides the above named species of the mulberry tree, there is one which we believe, from recommendations, to be superior to all others for the Culture of Silk. We allude to the Chinese Mulberry (*Morus Multicaulis*,) for a description of which see Vol. I. p. 315, Naturalist, or p. 21 Cobb's Manual on Silk. ED.

great quantity of fruit. The best reason, however, if it be correct, that has been given for preferring it, is, that the silk of worms which feed upon its leaves is finer than where other kinds are substituted. Count Dandolo has, indeed, found, that the quality of the filament does not solely depend upon the food of the insect, but is also influenced by the degree of temperature in which it is reared.

'In cold climates, the black thrives better than the white mulberry. It likewise bears double the quantity of leaves suitable for food. In Persia the silk worm is nourished altogether by leaves of the black species. In Granada, where silk of excellent quality is produced, the same system is followed. Swinburne, who travelled in Calabria in 1784, relates that the red species was there generally preferred, because the leaves, not appearing until ten or fourteen days later than those of the white mulberry, are therefore less subject to injury by frost. This reason for its preference is in other climates assigned as the cause of its rejection.

'The roots of the mulberry tree strike very deep into the ground, so that the surface not being impoverished as it is by many trees, whose roots are found more in the upper soil, other kinds of cultivation may be prosecuted around it. Neither its shade, nor the dropping of rain from its leaves, is considered prejudicial to plants growing beneath.

'Moist lands in valleys and near rivers induce a very rapid growth in the trees; but their leaves contain, in such situations, too much watery matter, and, though eaten voraciously, are hurtful to the worms from their comparative want of nourishment. The labors of the insects are also delayed, and the quality of their produce injured by the weakness of constitution resulting from this cause.

'Trees in dry soils give fewer leaves, but any deficiency in their quantity is amply compensated by the greater nutriment which they afford, and, as a necessary consequnece, by the superior quality of the silk produce.

'It is remarked by Mayet, that the quality of the silk depends upon that of the mulberry leaves consumed, "which are then to be considered as being only a mine worked by the worms; and this mine is more or less proper to furnish the fine substance, according to the soil and climate."

'The mulberry tree is readily raised, either by cuttings, by layers, or by seed. In countries where the seed must be saved until the favorable season for sowing it shall come round, the process is both troublesome and difficult. Pullein, who wrote in the year 1758, gives very elaborate directions, which

he considers necessary for properly saving and preparing the seed. In climates where this delay in sowing is not necessary, the operation is more simple. The plan pursued in France is curious: it is thus described:—"Take the ripe berries when they are full of juice and seeds. Next take a rough horse-hair line, or rope such as we dry linen on, and with a good handful of ripe mulberries, run your hand along the line, bruising the berries and mashing them as much as possible as your hand runs along, so that the pulp and seed of the berries may adhere in great abundance to the rope or hair line. Next dig a trench in the ground where you wish to plant them, much like what is practised in kitchen gardens in England for crops of various kinds. Next cut the rope or hair line into lengths, according to the length of the trench you think fit to make, and plunge the line full of mashed berries into the trench; then cover it well over with earth, always remembering afterwards to water it well, which is essential to success. The seeds of the berries thus sown will grow, and soon shoot out suckers, which will bear young leaves, which are the best food for the silk worm. The facility and rapidity with which young leaves may by this means be produced, is evident; for as many rows of trenches can thus be filled as can be wished; and it can never be necessary to have mulberry trees higher than our raspberry, currant or gooseberry bushes. Whenever they get beyond that, they lose their value; and if these branches succeed, you may have a supply coming fresh up day after day, or any quantity you please."

'Snails and slugs are found to be very destructive to the young mulberry shoots, committing great devastations in a short period. In moist seasons a whole nursery is sometimes threatened by them with ruin. To protect the tender plant from this evil, it is recommended to surround the beds or trenches with dry soot or ashes, sprinkling afresh after rain. This protection might be advantageously adopted with other plantations, as slugs will not pass over such a fence, especially while it is dry.

'In England, and countries of similar temperature, seedlings will not attain a greater height than three inches in the first year. In warmer climates their growth is much more rapid; so that in some parts of India large quantities of seed are sown, whose crops are mowed down in the ensuing season as food for silk worms. Sprouts again spring forth from the roots the same year, and are used for a second brood. The silk produced by worms fed on these tender shoots is supposed

to be readily distinguishable, by its superiority over that produced when the insect is fed on the leaf of the full-grown mulberry tree.

'Plants which are raised from seed require transplantation at the end of the third year, to induce the spreading of the root. Without this removal they would acquire only one root, like a pivot, and would be liable to various casualties on that account. Some cultivators believe that it assists this branching out of roots, if the plants are cut even with the ground at the end of the second year.

'The most easy and expeditious way of raising mulberry trees is from cuttings. Although as great a number cannot so readily be raised in this manner as from seed, there is a great advantage in point of strength as well as in the rapidity of their growth. This method of propagation is much more successful in moist and temperate climes than in such as are exposed to the arid heat of the lower latitudes. Cuttings will put forth shoots of about five or six inches in length during the first summer, and will, at the same time, be providing themselves with roots. If they have put forth shoots, and preserve their leaves until the autumn, the plants will generally succeed: any which have failed to do so must be replaced by other cuttings. In the course of the ensuing spring and summer, if carefully watered, the shoots will frequently attain the length of eighteen inches. In the autumn following the beds must be thinned, and the redundant saplings planted out.

'Mulberry plantations which are formed in France and Italy consist of large standard trees. This is a very inconvenient method; as the leaves cannot be gathered but by the aid of ladders, and by climbing among the branches. In this way the trees may sustain much injury; besides which a great deal of time is unnecessarily wasted in reaching the leaves, which then are seldom gathered with regularity.

'Du Halde, in his history of China, relates that the Chinese are particular so to place and to prune their mulberry trees, that the leaves may be gathered in the easiest manner, and without risk of damage to the trees. These are, with this view, cut in a hollow form, without any intersecting branches in the middle; so that a person going round the tree may gather all the outside leaves, and afterwards, by standing withinside, and merely turning round to the different parts, may pluck the leaves growing within. The trees are not allowed to grow to any great height; so that each tree forms a sort of round hedge, and may be reached throughout without climbing on its branches.

'Pullein gives very ample directions for forming and rearing plantations of mulberry trees. His work has been considered one of high authority, and may be profitably consulted by any who require more minute information than it is desirable to furnish in this volume.

'Ingrafting is considered to be one of the surest methods of obtaining nutritious leaves from mulberry trees. Monsieur Bourgeois observes, that mulberries ingrafted on wild stocks, when the graft is chosen from a good kind, such as the rose-leaved or the Spanish mulberry, produce leaves which are much more beautiful, and of much better quality for feeding silk worms, than such as are ingrafted on the common wild stock. The same observation has been made by Monsieur Thomé, whose authority is of the greatest weight in whatever relates to the rearing of silk worms, to which object he devoted forty years of his life.

'Although ingrafted mulberries certainly produce a greater number of leaves than the wild trees, and these leaves are thought to contain more nourishment to the insect, yet the wild tree has an advantage over that which is ingrafted, in its superior longevity. The former has been known to exist for two centuries; while the increased quantity of leaves produced by ingrafting causes a premature dissipation of the sap of the tree, and accelerates its decay. Monsieur Pomier, in a treatise which he has written upon the subject, recommends that white should be ingrafted on black mulberries; and the reason urged for the adoption of this plan is, that the white species commonly decays first in the root, while the black is not subject to any disease.

'The more attention that is bestowed upon the tree, by dressing and pruning the overgrown branches, the greater abundance of good leaves will it furnish. It is very hurtful to the trees to strip them when too young, because leaves are organs which fulfil important functions in plants, contributing greatly to their nutrition by absorbing vessels, which imbibe moisture from the air. The leaves may be safely gathered after the fifth year. Mulberry trees are so plenteously stored with sap, that they sometimes renew their leaves twice or thrice in the same year. When the winter has been mild, they put forth leaves very early; but it is always dangerous, in any but hot climates, to accelerate the hatching of the worms in expectation of this event; for no leaves should be depended on till the beginning of May, as those which appear prior to this period are exposed to destruction from frost.*

* For the culture of the mulberry in this country see Vol. I. p. 86. et seq. Naturalist, or Cobb's Manual. ED.

'According to Monsieur Nollet, the inhabitants of Tuscany, especially in the neighborhood of Florence, do not cultivate half as many trees as the Piedmontese, in proportion to the number of silk worms reared and the quantity of silk produced. This economy is realized by causing the worms to be hatched at two separate periods. The first brood is fed on the first leaves of the spring; and when these worms have gone through their progressions, and have produced silk, other eggs are hatched, and the insects are nourished by a seccond crop of leaves furnished by the same trees. This plan is followed in China, where two crops of silk are obtained in the year; and it has been said that in some other parts of Asia as many as twelve broods of worms are reared in the course of one year. In the Isle of France Monsieur Chazal obtained three generations between the months of December and May; the mulberry tree there, as well as in India, affording fresh leaves through the whole year.

'Count Dandolo is of opinion that in Italy it is disadvantageous to obtain more than one crop in each season. He affirms that the mulberry tree cannot bear this constant stripping of its leaves without injury. "All things considered," says he, "I am well persuaded that one of our good crops will be equal in produce to any number that may be gathered elsewhere in a year." It is observed that the quality of the silk obtained in Italy from their seccond *racolta* is always inferior to that from the first brood of worms.

'The Persian cultivators are accustomed, from a motive of economy, to feed silk worms upon boughs of the mulberry tree, instead of using the leaf separately, as is practised in all temperate climates. The leaves, continuing attached to the branches, remain longer fresh, have a better flavor, and are more nutritious, than those separately gathered, and the silk worms feed from the branches with less waste than when the leaves are strown singly over them.

'In estimating the qualities of the mulberry leaf, as regards nutrition, it should be considered as being composed of five different substances: the solid or fibrous, the saccharine, and the resinous substances, water, and coloring matter.

'The fibrous substance, water and coloring matter, cannot be said to contribute towards the nourishment of the silk worm. The saccharine matter is that which sustains the insect, causes its increase in size, and goes to the formation of its animal substance. The resinous substance, according to Count Dandolo, is that which, "separating itself gradually from the leaf, and attracted by the animal organization, accumulates, clears itself, and insensibly fills the two reservoirs or silk

vessels. According to the different proportion of the elements which compose the leaf, it follows, that cases may occur in which a greater weight of leaf may yield less that is useful to the silk worm, as well for its nourishment, as with respect to the quantity of silk obtained from the animal."

'To complete the developement of the silk worm, the quantity of leaves consumed must bear relation to the nutriment they contain. It is therefore important that leaves containing the most nutriment should be supplied to the insect, as it is more fatigued and more liable to disease from devouring many leaves, than it would be if an equal quantity of nourishment were supplied by fewer leaves containing more saccharine substance. Again, if this abounds in the leaf, and the resinous substance is not found united with it in sufficient quantity, the worm will, it is true, thrive and grow, but will not produce silk proportionate to its weight.

'In some parts of Italy and France, mulberry leaves are commonly sold by weight in the market, and those who rear silk worms are often wholly dependant on this source for supply. Judgment and experience are required in the purchaser, to enable him to make a proper selection of leaves, choosing such as are of a nourishing quality, and rejecting those whose sale would, from their greater weight, be more profitable to the vender. The interest of the two parties are consequently at variance. In other places, trees are hired for the season; from four to six francs, according to its size and condition, being paid for the hire of each tree. Under equal circumstances, an old mulberry tree always yields better leaves than a young one; and whatever may be the original quality of the tree, as it grows older the leaf will diminish in size, and will so materially improve, that at length it will attain to a very excellent quality.

'It is of importance that the age of the leaves should keep pace with that of the worms. The young leaf, being replete with aqueous matter, provides for the great evaporation continually proceeding from the body of the young worm; while the mature leaf contains a larger proportion of solid nutritive matter, better suited to the wants of the insect at its more advanced age. To give old leaves to young worms, or young leaves to old worms, would be alike prejudicial.

'The greatest care must be taken to prevent the leaves becoming heated or fermented. The nutritious substance of the leaf is altered and injured by the slightest fermentation, and it becomes too stimulating for the health of the worm. It is also essential that the leaves be given to the insects perfectly dry; contagious and fatal diseases will otherwise ensue.

'It is considered that a well-cultivated mulberry tree should yield, in each season, about thirty pounds of good leaves. It is not uncommon in the south of France to see large trees which will furnish five times this quantity.

'It is said that no insect except the silk worm will feed on the mulberry leaf. Pullein tried the speckled hair caterpillar, which feeds on the nettle, as well as several other kinds of insects, but they all rejected the mulberry leaf for their food. Once, indeed, he discovered upon a mulberry tree a green worm, about an inch long and as thick as an oat straw. He confined it in a box, and fed his prisoner with mulberry leaves. Pullein believes that it was not a native of the tree, but found itself there accidentally when it was taken. During the continued observation of three years, Miss Rhodes never once found an insect upon the leaves used by her. Other fruit trees and vegetables in the same garden were sometimes covered by myriads of insects, while the mulberry tree, surrounded by these ravagers, remained sacred from their depredations. Not even the aphides invade this tree, exclusively devoted to the use of the silk worm.'

DIFFERENCE OF CLIMATE.

A NOTICE to emigrants, by the society for forming a settlement in the Oregon Country, on the Columbia river, reminds us of some interesting facts connected with climate, which are, we imagine, new to most of our readers. One grand peculiarity, not yet explained satisfactorily, is the superior mildness of the climate of the western coast of a continent or island, over the eastern, or opposite coast, in the same latitude and elevation.

Thus, for example, while all is sterility and desolation on the eastern coast of North America, even as low as the 55th degree of north latitude, and ice and snow maintain a perpetual existence at the 60th parallel, we find on the coast of Norway, or western coast of Europe, ten degrees higher, that all is life, animation and beauty.

The difference of climate between the western coast of North America and the eastern coast of Asia is still more surprising, when we reflect that the parts of the two continents to be compared are only separated from each other by a strait, rather more than forty miles in width. Kotzebue, in his voyage of discovery, undertaken in 1815, informs us that the crossing of a short extent of water, from America to Asia, was like passing

from winter to summer. While all was verdure at Cape Prince of Wales in America, the opposite point of East Cape in Asia was covered with eternal ice. A few hours sailing directly to the west sank the thermometer from 59° to 43° F.

The general agent of the Oregon Society says, 'that the climate on the shores of the Columbia river is remarkably mild and healthful.' A person ignorant of the difference of climate between the two coasts of a continent, might naturally enough look at his map, and having discovered what spot of the eastern or Atlantic coast was of the same latitude as the mouth of the Columbia river, he would infer the mean annual temperature of the latter to be the same as that which he knows the former to possess. He would be deceived in that case, as in any other in which he would take parallels of latitude to measure climates, without reference to numerous modifying causes; among the chief of which, is the kind of exposure just mentioned.

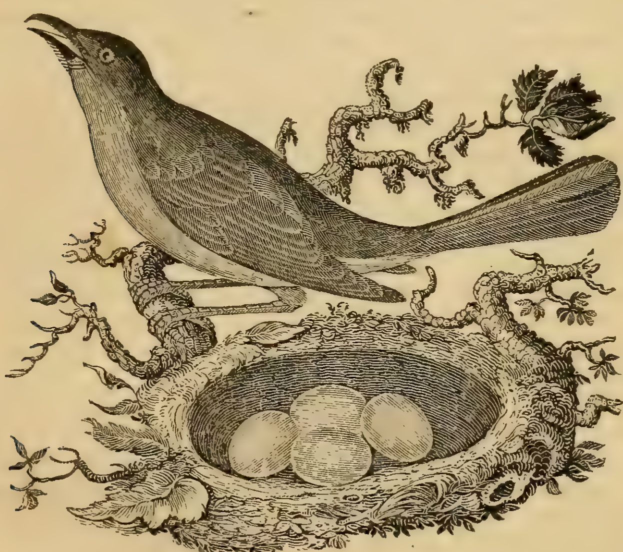
In New California, on the Pacific ocean, they cultivate with success the olive along the canal of Santa Barbara, and the vine from Montercy to the north of the parallel of 37° N. latitude, which is that of the country near the mouth of the Chesapeake Bay. The mouth of the Columbia river, in lat. 44° 40′ N. has a mean temperature of 55° F., the same as that of Pekin, in China, on the opposite continent, in lat. 39° 54′ N. Philadelphia, on the eastern side of the continent, is in about the same latitude as Pekin, or nearly five degrees farther south than the mouth of the Columbia river, and yet its mean temperature, 52° F., is three degrees less than that of the latter.

In corroboration of these views, for which we are indebted to the celebrated traveller Humboldt, it may be mentioned, that on the shores of the narrow channels of the Bosphorus and Dardanelles, dividing Europe from Asia, the western coast of the latter continent has a more genial climate than that of the former. In the spring, says Wittman, vegetation is several weeks more advanced on the Asiatic than on the European side, and the productions of the soil more vigorous and of larger growth.

So far, we see that marine exposures to the west appear to give a milder climate; and if we carry our investigations farther, we shall find that the mean annual temperature of places in the same latitude diminish as we advance to the east. Thus Warsaw, the capital of Poland, has a less medium temperature than Amsterdam, on the same line of latitude; is hotter in summer and colder in winter. Astrachan, at the mouth of the Volga, is nearly in the same latitude as Lyons.

The Crimea is not so warm as upper Italy, to which it corresponds, and although it also presents, equally with the latter, low grounds. Pekin is in the same parallel as Naples, but with less medium temperature, and exposed to much greater vicissitudes.

The interest with which the subject of climate is always studied, as well by the physician as by the naturalist and agriculturist, will justify our indulging in further details hereafter. We shall then show, that even the mean temperature of a place gives but an imperfect idea of its climate, unless we know the difference beween its temperature in summer and in winter.—*Journal of Health.*



THE CAT BIRD.

(*Turdus felivox,* Vieill. *T. lividus,* Wilson, ii. p. 90. pl. 20. fig. 3. Phil. Museum, No. 6770.)

Sp. Charact.—Dark slate color, paler beneath; the vent rufous; the crown and tail black, the latter rounded.

This quaint and familiar songster probably passes the winter in the southern extremities of the United States, and along the coast of Mexico, from whence, as early as February, they arrive in Georgia. About the middle of April they are

first seen in Pennsylvania, and at length leisurely approach this part of New England, by the close of the first or beginning of the second week in May. They continue their migration also to Canada; but whether they proceed into the desolate arctic wilderness or not, we are ignorant. They are said, however, to inhabit Kamtschatka, and consequently penetrate very far to the north. Throughout this extent, and to the territory of the Mississippi, they likewise pass the period of incubation and rearing their young. They remain in New England till about the middle of October, at which time the young feed principally upon wild berries.

The cat bird often tunes his cheerful song before the break of day, hopping from bush to bush, with great agility, after his insect prey, while yet scarcely distinguishable amidst the dusky shadows of the dawn. The notes of different individuals vary considerably, so that sometimes his song, in sweetness and compass, is scarcely at all inferior to that of the Ferruginous thrush. A quaintness, however, prevails in all his efforts, and his song is frequently made up of short and blended imitations of other birds, given, however, with great emphasis, melody, and variety of tone; and, like the nightingale, invading the hours of repose, in the late twilight of a summer's evening, when scarce another note is heard but the hum of the drowsy beetle, his music attains its full effect, and often rises and falls with all the swell and studied cadence of finished harmony. During the heat of the day, or late in the morning, the variety of his song declines, or he pursues his employment in silence and retirement.

About the twenty-fifth of May, one of these familiar birds came into the Botanic Garden, and took up his summer abode with us. Soon after his arrival he called up in low whisperings the notes of the *whip-poor-will*, the red bird, the *peto peto* of the tufted titmouse, and other imitations of southern birds, which he had collected on his leisurely route from the south. He also soon mocked the *'tshe-yàh 'tshe-yàh* of the little Acadian flycatchers, with which the neighborhood now abounded. He frequently answered to my whistle in the garden, was very silent during the period of incubation, and expressed great anxiety and complaint on my approaching the young after their leaving the nest. According to Latham, the cat bird is also capable of imitating the variable airs of instrumental music, and will sometimes mimic the cry of chickens so as to deceive and distress the hen that attends them.

One of the most remarkable propensities of the cat bird, and to which it owes its name, is the unpleasant, loud and

grating cat-like *mew* (*pay, pay, pay*) which it often utters, on being approached or offended. As the irritation increases, this note becomes more hoarse, reiterated and vehement; and sometimes this petulence and anger are carried so far, as to persecute every intruder who approaches the premises. This temper often prevails after the young are fledged, and though originating, no doubt, in parental anxiety, it sometimes appears to outlive that season, and occasionally becomes such an annoyance, that a revengeful and fatal blow from a stick or stone, is but too often, with the thoughtless and prejudiced, the reward of this harmless and capricious provocation. At such times, with little apparent cause, the agitation of the bird is excessive; she hurries backward and forward, with hanging wings, and open mouth, mewing and screaming in a paroxism of scolding anger, and alighting almost to peck the very hand that offers the insult. To touch a twig or branch in any part of the garden or wood is often amply sufficient to call down the amusing termagant. This harmless excess, and simulation of grimalkin's tone, that wizard animal, so much disliked by many, are unfortunate associations in the cry of the *cat* bird; and thus coupled with an ill name, this delightful and familiar songster, who seeks out the very society of man, and reposes an unmerited confidence in his protection, is treated with undeserved obloquy and contempt. The flight of the cat bird is laborious, and usually continued only from bush to bush; his progress, however, is very wily, and his attitudes and jerks amusingly capricious. He appears to have very little fear of enemies, often descends to the ground in quest of insects, and though almost familiar, is very quick in his retreat from real danger.

This common and abundant species begins to construct its nest some time in the month of May. The situation in which he delights to dwell, is commonly a dark thicket, in the woods, or close bush in some recluse part of the garden, at the distance of five or ten feet from the ground, according to the convenience of the situation. The materials are coarse but substantial; the external part is commonly made of small interlaced twigs, old grass and dry leaves; to these succeed thin strips of bark, often of the red ceder, somewhat agglutinated. The inside is lined and bedded with black root fibres of ferns; other accidental materials sometimes make a fantastic part of the fabric. One has been known to carry away an edging of lace which was missed, and at length again recovered after the rearing of the brood, whose dainty bed it assisted to form. I have frequently found in the external coat

of the nest, the cast off skins of *snakes*, more rarely bits of newspapers, wood shavings, strings, and bass-mat strips. The eggs are four or five, of a bright and deep emerald green, and without spots. According to the time of their arrival they raise two or even three broods in the season. The cat bird is not easily induced to forsake its nest. Wilson removed one containing four eggs, nearly hatched, from a grape vine into a thicket of briars close by, which was soon occupied by the female, as if nothing had happened to it. Other birds' eggs, those of the thrasher, and young of the same species, were instantly turned out of the nest in which they had been placed. Yet the male, divesting himself of selfish jealousy, observing the distress and helplessness of the young thus dislodged by his mate, began to feed them as his own. Their sagacity is therefore superior to that of the ordinary thrushes, as the *Turdus Wilsonii* is even one of the duped nurses occasionally employed by the cow bird.

The food of the cat bird is insects and worms, particularly beetles, and various garden fruits; feeding its young often on cherries, and other kinds of fruits. Sometimes they are observed to attack snakes when they approach the vicinity of their brood, and commonly succeed in driving off the enemy; when bitten, however, by the poisonous kinds, it is probable, as related, that they may act in such a manner, as to appear laboring under the influence of fascination. The cat bird, when raised from the nest, is easily domesticated, becomes a very amusing inmate, and seems attached to his cage, as to a dwelling or place of security. About dawn of day, if at large, he flirts about with affected wildness, repeatedly jerks his tail and wings with the noise almost of a whip, and stretching forth his head, opens his mouth and mews. Sometimes this curious cry is so gutteral as to be uttered without opening the bill. He often also gives a squeal as he flies from one place to another; and is very tame, though pugnacious to all other birds which approach him for injury. When wanting food, he stirs round with great uneasiness, jerks every thing about within his reach, and utters the feeble cry of the caged mocking bird. A very amusing individual, which I now describe, began his vocal powers by imitating the sweet and low warble of the song sparrow, as given in the autumn; and, from his lòve of imitation on other occasions, I am inclined to believe that he possesses no original note of his own, but acquires and modulates the songs of other birds. Like the robin, he is exceedingly fond of washing, and dashes about in the water till every feather appears drenched; he also, at

times, basks in the gravel in fine weather. His food, in confinement, is almost every thing vegetable, except unbruised seeds; as bread, fine pastry, cakes, scalded corn-meal, fruits, particularly those which are juicy, and now and then insects and minced flesh.

The length of this species is about nine inches. Above deep slate color, lightest on the edges of the primaries, and also considerably paler below. The under tail coverts reddish chesnut. Tail rounded. Upper part of the head, legs and bill, black. It occurs rarely pye-bald, with the head and back white, being nearly an albino. In a caged bird, I have also observed one or two of the tail feathers and primaries partly white on their inner webs. In the *young*, before the first moult, the rufous vent is paler, and the black of the head indistinct.—*Nuttall's Ornithology.*

DISSERTATION ON TOBACCO.

[A Dissertation on the Medical Properties and Injurious Effects of the Habitual use of Tobacco: read according to appointment, before the Medical Society of the county of Oneida, at their Semi-annual Meeting January 5, 1830. By A. McAllister M. D. Second Edition, Improved and enlarged, with an Introductory Preface, by Moses Stuart, Associate Professor of Sac. Lit. in the Theol. Inst. at Andover. Boston: Peirce & Parker, 1832.]

This work is accompanied with the following strong testimonial by Dr. Warren of this city, which cannot but secure it a wide circulation, and the attentive perusal of every man who values his health.

Dear Sir—In compliance with your request, I have read over the pamphlet of Dr. McAllister on the use of tobacco. Though my present occupations have prevented my doing it so carefully, as to entitle me to suggest any alteration or improvement.

The general tendency of the pamphlet is excellent: and I most cordially give my opinion in its favor: for I have often had occasion to observe the pernicious effects of the free use of tobacco. Many instances of dyspepsia have come under my notice, the origin of which was traced to the practice of *chewing;* and on the abandonment of the habit, the patients were restored to health. I have seen a number of cases of injury to the voice, from the introduction of *snuff* into the *facial sinuses.* As to *smoking*, I am well satisfied

that it is calculated to cause a feverish state of the body; and in certain constitutions it weakens the membranes which line the nostrils, throat and lungs, produces a susceptibility to colds, and even more serious affections of these parts, when it has been much employed.

From what I have seen, I have been led to believe that this article is not necessary nor useful for the preservation of health; and that it is often a cause of weakness and sickness.

Boston, Jan. 25, 1832. JOHN C. WARREN.

Note.—Many persons have the opinion that the use of tobacco is a preventative of contagious diseases; because it has been asserted that tobacconists and others living in the midst of the effluvia of this article, are exempted from the attacks of such disorders. The practices above alluded to have, in my opinion, a contrary effect. Those who live constantly in the region of tobacco, by the effect of habit cease to be stimulated and over excited by the diffusion of its lighter particles in the air they breath. But those who employ it occasionally, whether in smoking, chewing or snuffing, undergo an excitement, more or less considerable: which is infallibly followed by a proportionate debility, in which state they would be subject to the attacks of a disease they might otherwise have escaped. J. C. W.

In our next number we shall make an extract treating of the medical properties of tobacco, and the injurious effects attending its use, and of its political and moral influence.

MISCELLANEOUS INTELLIGENCE.

Feline Sagacity.

De la Croix relates the following almost incredible instance of sagacity in a cat, which, even under the receiver of an air pump, discovered the means of escaping a death that appeared to all present inevitable. 'I once saw,' says he, 'a lecturer upon experimental philosophy place a cat under the glass receiver of an air pump, for the purpose of demonstrating that very certain fact, that life cannot be supported without air and respiration. The lecturer had already made several strokes with the piston, in order to exhaust the receiver of its air, when the animal, that had began to feel herself very uncomfortable in the rarified atmosphere, was fortunate

enough to discover the source from whence her uneasiness proceeded. She placed her paw upon the hole through which the air escaped, and thus prevented any more from passing out of the receiver. All the exertions of the officer were now unavailing; in vain he drew the piston; the cat's paw effectually prevented its operation. Hoping to effect his purpose, he let air again into the receiver, which, as soon as the cat perceived, she withdrew her paw from the aperture; but when he attempted to exhaust the receiver, she applied her paw as before. All the spectators clapped their hands in admiration of the wonderful sagacity of the animal, and the lecturer found himself under the necessity of liberating her, and substituting another in her place, that possessed less penetration, and enabled him to exhibit the cruel experiment.'

Economical Fuel.

A good fire, on a winter's day, at a mere trifling expense, is of importance to a poor man. One penny worth of tar or rosin water will saturate a tub of coal with triple its original quantity of bitumen; (the principle of heat and light,) and of course render one such tub of three times more value than it was when unsaturated.

A new Practice of Painting.

(*Communicated to the Royal Institution of Great Britain.*)

Mr. Robertson paints in water colors and upon paper. He uses isinglass, dissolved in hot spirits of wine, between and over his colors, by which they acquire the brilliancy and force of oil; and when the picture is finished, he covers it with a colorless copal varnish. The pictures, when large, are covered with canvass and tin foil. The durability and steadfastness of the colors appear to be extreme.

Lamp Glasses.

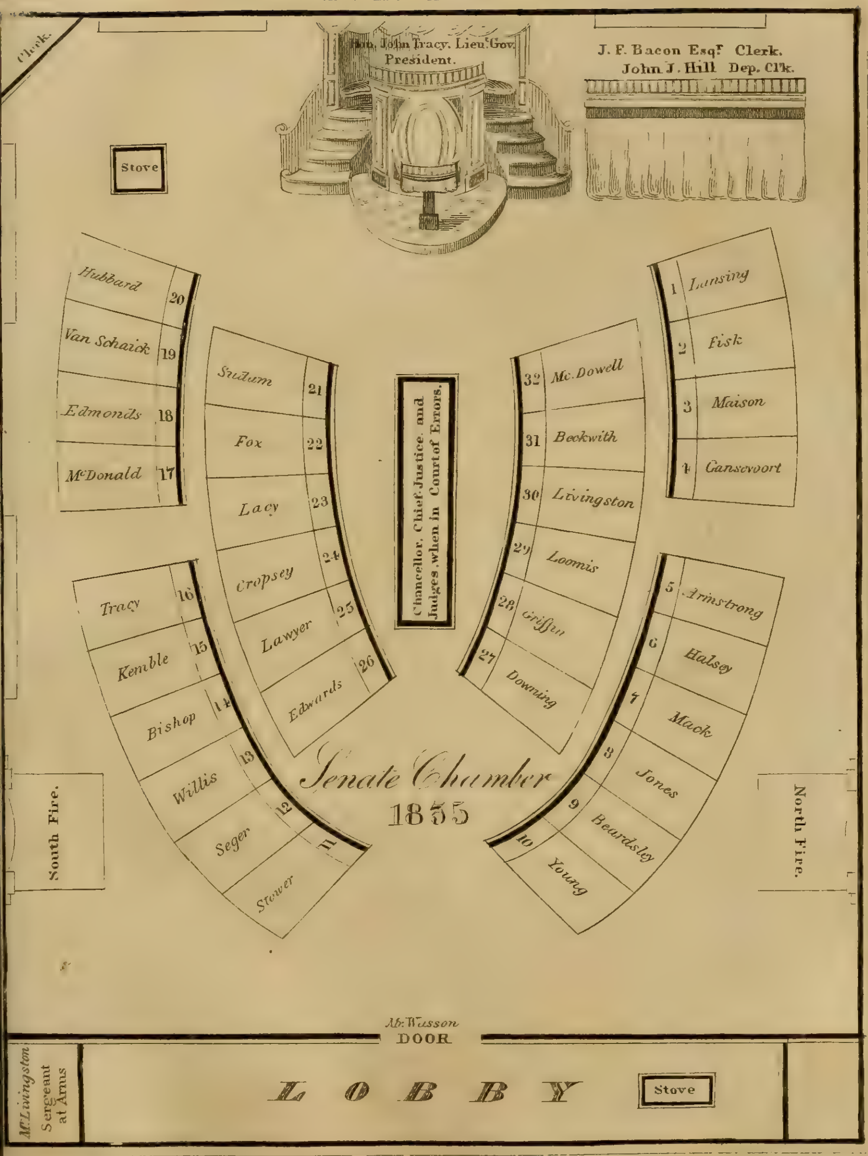
To prevent the cracking of lamp glasses, by a sudden expansion of heat; an effectual remedy is found in running a point of a diamond along the base of the tube. By this solution of continuity, it is relieved from the violence produced by the sudden effects of the heat. A glazier can best perform the operation with the diamond.—*Jour. de Connois. Usuelles.*

METEOROLOGICAL JOURNAL,

Kept at Boston, for January, 1832.

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	13	24	14	29.86	29.90	29.91	Fair	Fair	Fair	N. W.	N. W.	N. W.	
2	5	21	14	30.10	30.12	30.16	Fair	Fair	Fair	N. W.	S. W.	S. W.	
3	23	32	19	29.96	29.90	30.05	Cloudy	Fair	Fair	S. E.	S. W.	N. W.	0.11
4	6	16	10	30.21	30.35	30.36	Fair	Fair	Fair	N. W.	N. W.	N. W.	
5	16	36	33	30.16	30.08	30.08	Fair	Cloudy	Cloudy	S. W.	S. W.	S. W.	
6	32	37	36	30.02	29.93	29.92	Rain	Rain	Rain	S. E.	S. W.	S. W.	
7	23	26	22	30.16	30.24	30.30	Fair	Fair	Fair	N. W.	N. W.	N. W.	0.50
8	13	24	36	30.30	30.24	29.88	Cloudy	Cloudy	Rain	N. W.	N.	N. E.	
9	37	40	32	29.18	29.44	29.72	Cloudy	Fair	Fair	S. W.	S. W.	N. W.	1.58
10	27	38	32	29.80	29.79	29.75	Fair	Cloudy	Cloudy	W.	S. W.	S. W.	
11	31	32	22	29.63	29.58	29.72	Snow	Cloudy	Fair	S. W.	S. W.	N. W.	0.24
12	15	20	17	29.80	29.98	30.02	Fair	Fair	Cloudy	N. W.	N. W.	S. W.	
13	21	37	30	30.08	29.99	30.10	Fair	Fair	Fair	S. W.	S. W.	S. W.	
14	20	34	28	30.25	30.30	30.35	Fair	Fair	Fair	N. W.	N. W.	N. W.	
15	28	42	36	30.32	30.31	30.30	Fair	Fair	Fair	S. W.	S. W.	S. W.	
16	34	47	37	30.30	30.30	30.33	Fair	Fair	Fair	S. W.	S. W.	S. W.	
17	24	48	45	30.32	30.30	30.16	Fair	Fair	Fair	N. W.	S. W.	S. W.	
18	44	50	48	30.08	30.00	29.85	Rain	Cloudy	Cloudy	S. W.	S. W.	S. W.	0.25
19	46	48	37	29.80	29.80	29.92	Fair	Fair	Fair	S. W.	S. W.	W.	
20	34	40	33	30.00	30.05	30.08	Cloudy	Fair	Fair	W.	N. W.	N. W.	
21	31	38	24	29.93	29.90	30.10	Snow	Fair	Fair	W.	N. W.	N. W.	0.28
22	18	24	16	30.18	30.30	30.40	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	10	27	26	30.42	30.42	30.42	Fair	Fair	Fair	N. W.	N. W.	S. W.	
24	28	38	34	30.28	30.18	30.10	Cloudy	Cloudy	Cloudy	S. E.	S. E.	E.	
25	46	38	18	29.80	29.72	29.87	Rain	Cloudy	Snow	S. W.	N. W.	N. W.	0.88
26	4	8	1	30.00	30.25	30.41	Fair	Fair	Fair	N. W.	N. W.	N. W.	0.47
27	—4	10	2	30.42	30.40	30.40	Fair	Cloudy	Fair	N. W.	N. W.	N. W.	
28	—2	16	15	30.40	30.41	30.41	Fair	Fair	Cloudy	N. W.	N. W.	S. W.	
29	19	24	31	30.38	30.35	30.32	Snow	Snow	Snow	N. E.	N. E.	N. E.	
30	35	36	35	30.20	30.05	29.82	Cloudy	Rain	Rain	N. E.	N. E.	N. E.	0.38
31	31	32	24	29.92	30.02	30.19	Fair	Fair	Fair	N. W.	N. W.	N. W.	0.03

Depth of water fallen, 4.72 inches.



Clock.
Hon. John Tracy. Lieut. Gov. President.
J. F. Bacon Esqr. Clerk.
John J. Hill Dep. Clk.
Stove
Hubbard 20
Van Schaick 19
Edmonds 18
McDonald 17
Sudam 21
Fox 22
Lacy 23
Cropsey 24
Lawyer 25
Edwards 26
Tracy 16
Kemble 15
Bishop 14
Willis 13
Seger 12
Stower 11
Chancellor, Chief Justice, and Judges, when in Court of Errors.
32 Mc.Dowell
31 Beckwith
30 Livingston
29 Loomis
28 Griffin
27 Downing
1 Lansing
2 Fisk
3 Maison
4 Gansevoort
5 Armstrong
6 Halsey
7 Mack
8 Jones
9 Beardsley
10 Young
Senate Chamber
1835
South Fire.
North Fire.
Mr. Wasson
DOOR
Mr. Livingston Sergeant at Arms
LOBBY
Stove
G.W. Merchant Engr. & Pub.

1

2

Pendleton's Lithog.y Boston

GRAHAM ISLAND.

THE NATURALIST.

APRIL, 1832.

NOTICE OF GRAHAM ISLAND.

BY WM. AINSWORTH, ESQ. M. R. S. L.

The ejection of volcanic masses, or the elevation of the strata of the earth above the level of the soil or sea by natural causes, is of importance, remotely to all theories of the earth, and proximately to the true origin and formation of pseudo and active volcanic rocks and of craters of elevation.

This branch of geological inquiry has received a new impulse from the late researches of De Buch and Elie Beaumont, and every circumstance which tends to give consistency to opinions more or less theoretically deduced, is advantageous to science.

The elevation of Graham Island, in lat. 37° 11′ N., and long. 12° 44′ E., in the Mediterranean Sea, between Pantellaria and Sciacca, which took place in the month of July, 1831, has been observed at different stages of its progress, and has been attended with phenomena of such decided utility to this inquiry, that they will be my excuse for intruding upon your pages some remarks connected with its origin and general character.

The drawings which are represented by pl. iv. are from the pencil of Mr. W. Russell, of His Majesty's Ship St. Vincent, and are *fac similes* of the drawings sent by the same gentleman to His Royal Highness the Duke of Sussex, and since published by Ackermann; and of those transmitted to the Admiralty, and published in the Journal of the Royal Geographical Society. In both these cases the artists have made such alterations,

in rounding the outline and altering the true configuraion of the island, as materially to affect their utility in a scientific point of view.

According to published documents, the Neapolitan schooner Psyche discovered, on the 12th of July, smoke on the water between Sicily and Pantellaria, where the island is now situated; and, on the 17th of July, the master of the brig Adelaide, from London, distinguished fire; and it is probable that at this period the land rose to the surface. On the 18th of the same month, Commander C. H. Swinburne observed, from on board His Majesty's ship Rapid, a long irregular column of smoke or steam, accompanied by eruptions of fire, bearing south by east; the town of Marsala bearing by compass east half north 9 miles. On nearing, a small hillock of a dark color was observed a few feet above the sea. The volcano was at this period in a constant state of activity, discharging dust and stones with vast columns of steam. The island appeared to be 70 or 80 yards in its external diameter, and the lip as thin as it could be, consistent with its height, which might be 20 feet above the sea in the highest, and 6 feet in the lowest part, leaving the rest for the diameter of the area within.

From information accompanying Mr. Russell's sketch, it appears that the circumference of the island on the 23d was ¾ of a mile. The highest point was 80 feet above the level of the sea, and the jets of water rose to a height of from 800 to 1000 feet, and bore up immense quantities of cinders and stones, which sometimes attained nearly double that height.

On the 3d of August, Captain Senhouse of the St. Vincent effected a landing in the Hind cutter, and hoisted the British flag, calling it Graham Island. The form of the crater was found to be nearly a perfect circle, and complete along its whole circumference except for about 250 yards on its south-eastern side, which were broken and low, not apparently more than 3 feet high. The height of the highest part was found, upon a rough computation, to be 180 feet; the whole circuit of the island was from a mile and a quarter to a mile and a third. It bore the general appearance of two longitudinal hills, connected by intermediate low land sending up smoke and vapor in abundance. The circular basin, the centre of the island, was full of boiling salt water, of a dingy red color; and the vapor was very oppressive, causing nausea and faintness.

Captain Senhouse informs us that the fragments of rock brought away by the Hind cutter are compact and heavy, and that the whole surface of the island is dense and perfectly

hard under the feet. No variety of lava was procured, nor even any jet or streams of lava seen; and Mr. Osborne, surgeon to His Majesty's ship Ganges, states that the substances of which the island is composed, are chiefly ashes, the pulverized remains of coal deprived of its bitumen, iron scoriæ, and a kind of ferruginous clay, or oxided earth. The scoriæ occur in irregular masses, some compact, dense and sonorous, others light, friable, and amorphous, with metallic lustre, slightly magnetic, barely moving the loadstone. A piece of limestone was also found thrown up with the other substances, having no marks of combustion. There were, according to the same observer, no traces of lava, no terra puzzolana, no pumice, nor other stones, usually found on volcanic hills.

It will at once be observed, in the sketches of the island which are represented by pl. iv., that its appearance differs very much according to the distance at which it is viewed. In Fig. 1, it is the summit of a volcano, a cone of eruption slightly elevated above the level of the sea; but, on a nearer approach, its form is found to be that of a circular crater with more or less perpendicular walls (Fig. 2.) like most of the craters of elevation surrounding the internal craters of volcanoes, or the islands and insulated formations of supposed similar origin. The internal crater on the left hand side of Fig. 2, which presents the most striking manifestation of this disposition, has been obliterated in the sketch contained in the Journal of the Royal Geographical Society, and occupied by smoke and a prodigious flash of lightning.

There is every reason to believe that volcanic eruptions take place at the bottom of the sea, in the same manner as on the surface of a continent; and Mr. Osborne points out the fact that, in the elevated sides of the external ridge of the island, the sides fall down in abrupt precipices; and each stratum could be distinctly discerned, the water evaporating having left an incrustation of salt, which now appears a white firm layer, plainly marking the regular progress and formation of the island. It is very evident that this kind of action and succession could not have taken place above the level of the waters either of the sea or of the internal crater; as it further demonstrates that horizontal beds of volcanic matters, accumulated over each other, can be directed on a given point without any violent contortion or derangement of their symmetry and parallelism. Nor have we, in the present case, any invasion of the sea or explosions posterior to the formation of the cone, if we may judge from the details transmitted to us of the elevation and appearance of the island, to account for the well

characterised circus or mural precipice which surrounds the canal of communication or crater of eruption.

It does not farther appear, from the soundings, that this island is the summit of a cone of eruption with an open crater. Captain Swinburne found, within 20 yards on the western side, 18 fathoms soft bottom; and Capt. Smith found, at 100 yards, the island bearing from N. to N. W., from 60 to 64 fathoms; at 80 yards, the island bearing N. E., 70 to 75 fathoms; at 150 yards, the island bearing E., 62 fathoms, cinders: the soundings continuing the same to the distance of five or six miles; that is to say, varying from 60 to 70 and 80 fathoms, sand and small gravel. The extent of the action by which this island was elevated from below is uncertain. It is a curious fact, that the tides were higher at that period at Gibraltar than they were ever known to be; but the connection of this phenomenon with the elevation of submarine formations requires the evidence of correlative observations.

Captain Swinburne observed the interior of the crater to be filled with muddy water, violently agitated, dashing up and down, and shooting hot stones and cinders into the air; and occasionally running into the sea, over the edge of the crater, which was broken down to the level of the sea on the west-south-west side for the space of 10 or 12 yards. This edge he supposed, from these appearances, to be formed of cinders and mud: a supposition which is contradicted by the consideration that an embankment of such materials, and of such slight thickness, could never retain the mass so violently agitated in the interior; and is farther opposed to the statements of Captain Senhouse and Mr. Osborne.

The isolation of the volcanic action is also demonstrated by the fact, that the temperature of the sea, within 10 or 12 yards of the crater, was only 1° higher than the average; and to the leeward, in the direction of the current, it was not at all affected, though a *mirage* played on the island.

There was at a subsequent period of the eruption, on the south-west side of the island, adjoining the principal crater, a terrific ebullition and agitation of the sea, apparently seated in another canal of communication; attended by the emission of a dense white steam, and a temperature increased to 190° Fahr.; and the information has, I believe, since reached the Admiralty, that this crater is now elevated above the level of the waters. De Buch has already pointed out, that the internal action which manifests itself at the surface of the soil or sea by a crater of elevation, may constitute at the same time a permanent volcanic crater beneath; the eruptions of which

may take place sometimes by the centre of the crater of elevation, sometimes by neighboring points.

Though it is difficult, from the meagre details hitherto obtained, to form any correct opinion of the minerological character of the upraised mass, yet there is nothing in those details to warrant the supposition that there is no stability or permanence in the composition of the island. The pulverized remains of coal deprived of its bitumen, the hard scoriæ, dense and sonorous (phonolites?) the amorphous rocks with metallic lustre and ironstone clay, would appear to associate the eruption with the rocks of the carboniferous series—an opinion which receives additional probability from the ejection of unchanged pieces of limestone; as we see, between Pettycur and Bruntisland in Fifeshire, beds of limestone and of non-bituminous coal elevated by rocks of plutonic origin, and argillaceous and argillo-calcareous rocks changed into leucostines and spilites.—*Magazine of Natural History.*

Note.—The last account of this island states that it exists no more since the 20th of December last, when it sunk at the time of a violent earthquake. At the place where it was situated there now remains a kind of rock covered with a shallow depth of water. Ed.

CONCHOLOGY.

NO. II.

Of the Constituent Parts of Shells. The nature and component parts of testaceous substances have been particularly investigated by Mr. Hatchett, from whose paper we extract the following observations.

In his examination of marine shells, Mr. Hatchett found, from the nature of the substance of which they are composed, that they might be arranged in two divisions.

Under the first are included those which have a porcellaneous appearance and enamelled surface, and exhibit, when broken, something of a fibrous texture. The other division is distinguished, by having a strong epidermis or covering, under which is the shell, composed principally or entirely of mother of pearl. To the first division belong different species of voluta, cypræa, and others. The second comprehends the oyster, the river muscle, and some species of haliotis and turbo.

Porcellaneous Shells. The shells of this description

which were examined, were different species of voluta and cypræa. When they were exposed to a red heat for a quarter of an hour, they crackled and lost the colors of their enamelled surface. No apparent smoke, and no smell, like that of burnt horn or cartilage, were emitted during the process. The figure remained the same, excepting a few flaws; and they became of an opaque white, partially tinged with pale gray. When they were dissolved in acids, after being burnt, they deposited a small quantity of animal coal, which proves that they contain some portion of gluten. Shells, which had not been exposed to the fire, dissolved with great effervescence in the different acids, and the solution remained transparent and colorless; from which it appears, that the proportion of gluten is small, since it could not be traced in the solution of the unburnt shells.

In examining the different solutions of shells, whether burnt or unburnt, by chemical tests, it was found that no trace of phosphate of lime, or of any other combination of phosphoric acid, existed in these substances; and it appeared, from many experiments, that the component parts of porcellaneous shells are carbonate of lime, cemented with very small portions of animal gluten.

Some species of patella, which were brought from Madeira, were also subjected to chemical examination by the same philosopher. When exposed to a red heat, in a crucible, they emitted a perceptible smell of burnt horn or feathers; and, by farther examination, by solution, the proportion of carbonic matter deposited, appeared to be greater, and the proportion of carbonate of lime less, than what was indicated by the result of the experiments on porcellaneous shells. When unburnt shells, belonging to the same species, were immersed in nitric acid, very much diluted, the epidermis separated, and the whole of the carbonate of lime was dissolved. A gelatinous substance, nearly in a liquid state, remained, but it did not retain the figure of the shell, and exhibited no appearance of a fibrous structure. These shells, therefore, contain a larger portion of gelatinous matter than the porcellaneous shells; but the other component part consists entirely of carbonate of lime.

Shells composed of Mother of Pearl. Shells of this description were subjected to similar experiments with the former. When the common oyster was exposed to a red heat, the effects were the same as those which were produced by the same process on the species of patella from Madeira.

The solution of the unburnt shell was also similar, excepting only that the gelatinous part was of a greater consistency. When the river muscle was burnt in a crucible, it emitted much smoke, with a strong smell of burnt horn or cartilage; the shell became of a dark gray color, and exfoliated. By solution in the acids, the proportion of carbonic matter separated was greater, and that of carbonate of lime obtained was less, than from the other shells on which experiments were made.

When an unburnt shell of this description was immersed in diluted nitric acid, a rapid solution and effervescence took place, and, at the end of two days, the whole of the carbonate of lime was nearly dissolved. A series of membranes now only remained, of which the epidermis constituted the first. These membranes still retained the figure of the shell. The carbonate of lime was at first readily dissolved, because the acid came easily in contact with it; but the process became slower as it was more difficult for the acid to insinuate itself between the different membranes of which the shell is composed. The *Haliotis iris*, and the *Turbo olearius*, were found to resemble this muscle, except that the membranaceous parts were more compact and dense.

When these shells are deprived, by an acid, of the carbonate of lime, which gives them their hardness, they appear to be formed of different membranes, applied stratum super stratum. Each membrane is furnished with a corresponding coat or crust of carbonate of lime, and it is so situated, that it is always between every two membranes, beginning with the epidermis, and ending with the internal membrane, which has been last formed. The animals which inhabit these stratified shells, increase their habitation by the addition of a stratum of carbonate of lime, which is secured by a new membrane. And, as every additional stratum exceeds in extent that which was previously formed, the shell becomes stronger in proportion as it is enlarged; and thus the growth and age of the animal may be denoted by the number of strata of which the shell is composed. Similar experiments were made on species of mother of pearl, as they are imported from China, and with precisely the same results. They appeared to be composed of the same gelatinous matter, and carbonate of lime. In all the shells of this description which were immersed in acids, the membranaceous parts retained the exact figure of the shell, and they appeared distinctly to be composed of fibres, arranged in a parallel direction, corresponding to the configuration of the shell.

Pearl. The constituent parts of pearl appear to be similar to those of mother of pearl. They are composed of concentric coats of membrane and carbonate of lime, and resemble, in structure, the globular, calcareous concretions, which are known by the name of *pisolithes.* The iridescence and undulated appearance of pearl and mother of pearl, evidently depend on their lamellated structure and semi-transparency. From these experiments, it appears that shells are composed of carbonate of lime and gluten. In some, as in the porcellaneous shells, the proportion of carbonate of lime is great, while that of the animal matter is small; and these may be regarded as the beginning of the series, while shells that come under the description of mother of pearl are to be placed at the other extremity, having a smaller proportion of carbonate of lime, and a greater proportion of membranaceous substance. In the first, the carbonate of lime is nearly cemented by the animal matter; in the latter, the carbonate of lime serves to harden the membranaceous substance. But between these two extremes, in the proportion of carbonate of lime and animal gluten, of which all testaceous substances are composed, there are, no doubt, numerous intermediate gradations, arising from the nature of the animal to which they form a covering, its peculiar habits, or mode of life.

ORNITHOLOGY.

NO. IV.

Song of birds. As the song of birds is not allowed to be the effect of love, by an honorable author on the subject of singing birds,* we shall endeavor to elucidate this matter from experiments on birds, in their natural wild state; and also endeavor to prove that their notes are innate, contrary to that author's opinion. That confined birds will learn the song of others they are constantly kept with, there is no doubt; but then it is generally blended with that peculiar to the species. In the spring, the very great exertions of the male birds in their vociferous notes are certainly the calls to love; and the peculiar note of each is an unerring mark for each to discover its own species. If a confined bird had learned the song of another, without retaining any part of its natural

* Daines Barrington.

notes, as was set at liberty, it is probable it would never find a mate of its own species; and even supposing it did, there is no reason to believe the young of that bird would be destitute of its native notes; for if nestling birds have no innate notes peculiar to the species, and their song is only learned from the parent bird, how are we to account for the invariable notes each species possess, when it happens that two different species are bred up in the same bush, or in one very contiguous, or when hatched or fostered by a different species? There is every reason to believe it is necessary that there should be native notes peculiar to each species, or the sexes might have some difficulty in discovering each other, the species be intermixed, and a variety of *mules* produced; for we cannot suppose birds discriminate the colors by which their species are known, because some distinct species are so exactly alike that a mixture might take place. The males of song birds, and many others, do not in general search for the female, but, on the contrary, their business in the spring is to perch on some conspicuous spot, breathing out their full and amorous notes, which, by instinct, the female knows, and repairs to the spot to choose her mate. This is particularly verified with respect to the summer birds of passage. The nightingale, and most of its genus, although timid and shy to a great degree, mount aloft, and incessantly pour forth their amorous strains, each seemingly vieing in its love-labored song before the females arrive. No sooner do they make their appearance than dreadful battles ensue, and their notes are considerably changed; sometimes their song is hurried through without the usual grace and elegance; at other times modulated into a soothing melody. The first we conceive to be a provocation to battle on the sight of another male; the last an amorous cadence, a courting address. This variety of song lasts no longer than till the female is fixed in her choice, which is in general in a few days after her arrival; and if the season is favorable, she soon begins the task allotted to her sex.

The male now no more exposes himself to sing as before, nor are his songs heard so frequently, or so loud; but while the female is searching for a secure place to build a nest he is no less assiduous in attending her with ridiculous gestures, accompanied with notes peculiarly soft. When the female has chosen a spot for nidification, the male constantly attends her flight to and from the place, and sits upon some branch near, while his mate instinctively places the small portion of material she each time brings to rear a

commodious fabric for her intended brood. When the building is complete, and she has laid her portion of eggs, incubation immediately takes place. The male is now heard loud again, but not near so frequently as at first; he never rambles from her hearing, and seldom from her sight; if she leaves her nest he soon perceives it, and pursues her, sometimes accompanied with soft notes of love. When the callow brood appear, he is instantly apprised of it, either by instinct or by the female carrying away the fragment shells to some distant place. The male is now no more heard in the tuneful glee, unless a second brood should force the amorous song again; his whole care and attention is now taken up in satisfying the nutrimental calls of his tender infant race, which he does with no less assiduity than his mate, carrying them food, and returning frequently with muting of the young in his beak, which is dropped at a distance from the nest. Here we must beg leave to digress for a moment to remark, that, with the utmost attention, we have never been able to discover the parent birds giving their young a musical lesson; and much question if the late brood of many species ever hear the song of their parents, till they join chorus the ensuing spring, when they also feel the impulse of love, the great dictate of nature.

The continuation of song in caged birds, by no means proves it is not occasioned by the stimulus of love; indeed, it is likely the redundancy of animal matter, from plenty of food and artificial heat, may produce it; and this is sufficient reason for continuing their song longer than birds in their natural wild state, because they have a constant stimulus; whereas wild birds have it abated by a commerce with the other sex, by which, and other causes, it is prevented. It is true wild birds are heard to sing sometimes in the middle of winter when the air is mild, animated by the genial warmth of the sun, which acts as a stimulus.

Syme's remarks on the songs of birds are worth quoting. 'The notes,' says he, 'of soft-billed birds, are finely toned, mellow and plaintive; those of the hard-billed species are sprightly, cheerful and rapid. The difference proceeds from the construction of the larynx; as a large pipe of an organ produces a deeper and more mellow-toned note than a small pipe, so the *trachea* of the nightingale, which is wider than that of the Canary, sends forth a deeper and more mellow-toned note. Soft-billed birds, also, sing more from the lower part of the throat than the hard-billed species. This, together with the greater width of the larynx of the nightingale and

other soft-billed warblers, fully accounts for their soft, round, mellow notes, compared with the shrill, sharp and clear ones of the Canary and other hard-billed songsters. In a comprehensive sense, the complete song of birds includes all the notes they are capable of uttering; and, taken in this sense, it is analogous to the speech of man. It is the vehicle through which these little creatures communicate and convey to each other their mutual wishes and wants. It may be divided into six distinct separate sounds or parts, each of which is very expressive, even to us, of the feelings which agitate the bird at the moment. To describe their song more fully, we shall divide it in the following manner: *First*, the call note of the male in spring; *second*, the loud, clear, ardent, fierce notes of defence; *third*, the soft, tender, full, melodious, love warble; *fourth*, the notes of fear or alarm, when danger approaches the nest; *fifth*, the note of alarm or war cry, when a bird of prey appears; *sixth*, the note the parent birds utter to their brood, and the chirp or note of the young. The note of the young may be again divided into two,—that which they utter while in the nest, and the chirp after they leave it,—for they are very distinct sounds or notes; to which may be added, a soft, murmuring kind of note, omitted by the male while he is feeding the female in the nest; and also by her while she is receiving the food. The call note, the warble of love, and the notes of defiance, or prelude to battle, seem only to be understood by birds of the same species, at least in a wild state. Perhaps in a state of domestication, birds of different genera, if nearly allied, may partially comprehend these notes, as the canary bird does the notes of the siskin, the goldfinch and the linnet. But this, we think, is more occasioned by necessity than by choice in these birds; and, in this case, it is man who breaks down the barriers which nature has so wisely put between different species. The note of fear or alarm of the cock bird, by which he gives notice to the hen of the approach of danger near the nest, and which she perfectly understands—for she either keeps close, or quietly makes her escape; this note, we think, is only comprehended by birds of the same species, though we have certainly seen birds of different genera appear as if alarmed by this note of fear, sounded by a bird of different species and genus; but whether it was the note that alarmed them, or our presence, we cannot say. But we are pretty sure, the notes of parent birds, and the chirp of the young, are only understood by birds of the same species, or rather we should say, family, for it appears to be a family language,

understood reciprocally by parent birds and their young; for the young know the notes of their parents, and the parents of their own brood, among all the young broods of other birds of the same species in the neighborhood, and this they do, as distinctly as the ewe knows the bleat of her own lamb, or the lamb the cry of its own mother, among a large flock. With regard to the note of alarm, birds send forth on the approach of their natural enemies, whether a hawk, an owl or a cat, we consider it to be a general language perfectly understood by all small birds, though each species has a note peculiar to itself. This note differs in sound from the note of fear or alarm, given by them when man approaches near their nest. This last seems confined to a species; but this general alarm note, (which is understood by all small birds,) we would call their war whoop or gathering cry, for it is a true natural slogan. All the notes comprised in the song of birds convey delight to the mind of a lover of nature; but the bird fancier only prizes their love warble, and notes of defiance; these notes, and these only, he considers to be their song. The musical notes of birds, whether of love or war, are sweet, and really charming in themselves; but they perhaps pour on the mind a greater degree of pleasure than mere sound is capable of conveying—we mean the recollections of youthful days, of endearing incidents, or of scenes connected with country pleasure. We ourselves prefer the mellow, plaintive melody of the soft-billed species; but others give the palm to the cheerful warble of the hard-billed tribe: which of these two styles is the sweetest melody we cannot determine. Both warbles may be equally fine; and the preference, perhaps, may depend on taste and feeling. But it is allowed, by all who have an ear for music, or rather we should say, who have an ear and love for simple, natural melody, that the song or warble of birds is truly delightful; but all their musical notes cease as soon as the brood is hatched.'

We may be permitted to inquire, since birds sing in a pitch so irregular, and with intervals so unsettled, exhibiting a total disregard to measure and rhyme, what makes their music pleasing? The cause has been traced to association; for they sing but in fine weather, and when pleased; and for the last reason, even the *sostenuto* of the cat is not unpleasing. The variety and rapidity of their notes and intonation also awakens attention; and the contrast between rapid flights of double-demi-semi-quavers, and lengthened and sweet minims, is often wonderful; such as the soft and sustained notes of the nightingale, succeeded by a short and expressive passage

of quicker sound. It is, perhaps, too much to say, that we have borrowed all our music from birds; but some of it is evidently a plagiarism.

The cuckoo itself has done more for our music than musicians may be willing to allow, but it is no more than just to a despised bird to say, that from it we have derived the *minor scale*, whose origin has puzzled so many,—the cuckoo's couplet being the *minor third* sung downwards.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. IV.

Mode of rearing Silk Worms in China. 'Before entering upon any description of the methods practised in Europe for rearing silk worms, it appears desirable to give a brief account of the means employed for that end in China. It will be seen, from this sketch, how superior, in many respects, were the arrangements of the Chinese cultivators; and that in departing from the course so long pursued by them, Europeans made choice of modes less rational and simple for attaining the desired result. The inquiries and experiments of later days have brought us back from the confused procedures, which so long imparted uncertainty, and so frequently led to disappointment, and have introduced, instead, judicious and methodical arrangements.

'In those parts of the empire where the climate is favorable to the practice, and where alone, most probably, the silk worm is indigenous, it remains at liberty, feeding at pleasure on the leaves of its native mulberry tree, and going through all its mutations among the branches, uncontrolled by the hand and unassisted by the cares of man. So soon, however, as the silken balls have been constructed, they are appropriated by the universal usurper, who spares only the few required to reproduce their numbers, and thus to furnish him with successive harvests.*

'This silk, the spontaneous offering of nature, is not, however, equal in fineness to that which is spun by worms under shelter, and whose progressions are influenced by careful attendance. Much attention is, therefore, bestowed by the

* For the description of the silk worm, see Naturalist, Vol. I.

Chinese in the artificial rearing of silk worms. One of their principal cares is to prevent the too early hatching of the eggs, to which the nature of the climate so strongly disposes them. The mode of ensuring the requisite delay is, to cause the moth to deposit her eggs on large sheets of paper: these, immediately on their production, are suspended to a beam of the room, and the windows are opened to expose them to the air. In a few days the papers are taken down and rolled up loosely with the eggs within-side, in which form they are hung again during the remainder of the summer and through the autumn. Towards the end of the year they are immersed in cold water wherein a small portion of salt has been dissolved. In this state the eggs are left during two days; and on being taken from the salt and water are first hung to dry, and are then rolled up rather more tightly than before, each sheet of paper being thereafter inclosed in a separate earthen vessel. Some persons, who are exceedingly particular in their processes, use a ley made of mulberry tree ashes, and place the eggs likewise, during some minutes, on snow water, or otherwise on a mulberry tree exposed to snow or rain.

'These processes appear efficacious for checking the hatching, until the expanding leaves of the mulberry tree give notice to the rearer of silk worms, that he may take measures for bringing forth his brood. For this purpose the rolls of paper are taken from the earthen vessels, and are hung up towards the sun, the side to which the eggs adhere being turned from its rays, which are transmitted to them through the paper. In the evening the sheets are rolled closely up and placed in a warm situation. The same proceeding is repeated on the following day, when the eggs assume a grayish color. On the evening of the third day, after a similar exposure, they are found to be of a much darker color, nearly approaching to black; and the following morning, on the paper being unrolled, they are seen covered with worms. In the higher latitudes the Chinese have recourse to the heat of stoves, to promote the simultaneous hatching of eggs.

'The apartments in which the worms are kept stand in dry situations, in a pure atmosphere, and apart from all noise, which is thought to be annoying to the worms, and especially when they are young. The rooms are made very close, but adequate means of ventilation are provided: the doors open to the south. Each chamber is provided with nine or ten rows of frames, placed one above the other. On these frames rush hurdles are ranged, upon which the worms are fed through all their five ages. A uniform degree of heat is constantly pre-

served, either by means of stoves placed in the corners of the apartments, or by chafing dishes which from time to time are carried up and down the room. Flame and smoke are always carefully avoided : cow dung dried in the sun is preferred by the Chinese to all other kinds of fuel for this purpose.

'The most unremitting attention is paid to the wants of the worms, which are fed during the night as well as the day. On the day of their being hatched they are furnished with forty meals, thirty are given in the second day, and fewer in and after the third day. The Chinese believe that the growth of silk worms is accelerated, and their success promoted, by the abundance of their food ; and therefore, in cloudy and damp weather, when the insects are injuriously affected by the state of the atmosphere, their appetites are stimulated by a wisp of very dry straw being lighted and held over them, by means of which the cold and damp air is dissipated.

'It is affirmed by these accurate observers, that the quicker the worm arrives at its maturity, the greater is the quantity of silk which it spins. They say, that if the worms become fully grown in twenty-five days, each drachm of eggs will produce twenty-five ounces of silk ; that if their maturity be delayed to the twenty-eighth day, only twenty ounces are obtained ; and that if thirty or forty days elapse between the hatching and the commencement of the cocoons, then only ten ounces are the result.

'The Chinese are exceedingly careful in preserving the nicest degree of cleanliness in their establishments for rearing silk worms; being fully aware of the great importance which attaches to that particular.

'The worms, as they increase in growth, have gradually more space assigned to them ; so that the full-grown caterpillars have four times the scope that is allotted to them when newly hatched, and sometimes even more.

'When the insects are about to commence their spinning, mats are provided, in the centre of which a strip of rush, about an inch broad, is fixed, and extended in a spiral form, or in concentric circles, over the whole surface of the mat, leaving an area of about an inch broad between each circle. Here the worms fix themselves to spin ; and it is found that these receptacles occasion less silk to be wasted by them in floss, than when more space is allotted wherein their first threads can be spun. At this time the whole room is carefully covered with mats, to exclude the outward air and the light, as it is believed that silk worms work more diligently in darkness.

'In seven days from the commencement of the cocoons, they are collected in heaps; those which are designed to continue the breed being first selected and set apart on hurdles, in a dry and airy situation.' The next care is to destroy the vitality of the chrysalides in those balls which are to be reeled. The most approved method of performing this is to fill large earthen vessels with cocoons, in layers, throwing in one fortieth part of their weight of salt upon each layer, covering the whole with large dry leaves resembling those of the water lily, and then closely stopping the mouths of the vessels. In reeling their silk, the Chinese separate the thick and dark from the long and glittering white cocoons, as the produce of the former is inferior.

'In India, the climate admits of silk worms being reared in buildings resembling sheds rather than houses. They are composed of lattice work, and their roofs are covered with thatch. The breadth of such buildings is usually fifteen feet, and their height eight feet; their length is regulated by the extent of accommodation required. In the centre of the apartment a path is left, of convenient width for the attendants to pass and repass in supplying the wants of their charge; and on either side are twelve tiers or stages, one above another, of open frame work, or shallow boxes made of bamboo, in which the worms are placed. When ready to spin, each worm is individually transferred to a small cell formed with platted strips of bamboo.'

MEDICINAL PROPERTIES OF TOBACCO.

These are considered to be those of a powerful *narcotic*, *antispasmodic*, *emetic*, *cathartic*, *sudorific*, and *diuretic*.

'As a *narcotic*, it is endued with the most energetic, poisonous properties, producing, when administered even in small doses, severe nausea and vomiting, cold sweats, universal tremors, with extreme muscular debility.' From its exerting a peculiar action on the nervous system, as ascertained by the well-directed experiments of Mr. Brodie, it powerfully controls the action of the heart and arteries, producing invariably a weak, tremulous pulse, with all the apparent symptoms of approaching death. And so different is its operation from that of other narcotics, that it actually operates with more destructive efficacy, when used by way of injection,

than when applied either to the skin, or when taken into the stomach.

From what has been said of its narcotic powers, you, Gentlemen, will readily infer its virtue as an article of *medicine.* If we wish, at any time, to prostrate the powers of life in the most sudden and awful manner, we have but to administer a dose of tobacco, and our object is accomplished. Hence its use in obstinate constipation, in cholic, in the iliac passion, and in stranguary.

As it is conceded that its efficacy as an *antispasmodic* depends upon its power to prostrate every vestige of tone and elasticity in the muscular fibre, prudence would dictate that it should be used with the utmost circumspection, when the system had been previously exhausted by the disease, or by the antecedent method of cure. Melancholy instances are on record, of the fatal effects of this medicine when administered without this caution, both as an internal remedy, and as an external application in cutaneous diseases. Two instances will suffice.

'A medical practitioner,' says Paris, 'after repeated trials to reduce a strangulated hernia, injected an infusion of tobacco, and shortly after sent the patient in a carriage to the Westminster Hospital, for the purpose of undergoing the operation; but the unfortunate man arrived only a few minutes before he expired.'

'I knew a woman,' says the same learned author, 'who applied to the heads of three of her children, afflicted with scald-head, an ointment composed of snuff and butter; but what was the poor woman's surprise, to find them immediately seized with vertigo, violent vomiting, fainting, and convulsions.'

We next come to its effects as an *emetic.* 'As such,' says Professor Chapman, 'tobacco claims our attention.' 'Cullen and many others opposed its use, on account of the harshness of its operation. Certainly it exceeds all others in the promptness, violence and permanence of its impressions. But these very qualities, unpleasant as they are, enhance its value in many cases.'

'Tobacco seems especially to be adapted to the evacuation of some poisons; and it has this advantage, that it acts with equal certainty and expedition, when applied to the region of the stomach in the form of a poultice, as when internally administered.' Professor Barton says, he had recourse to an application of the moistened leaves of this plant to the region of the stomach, with complete success, to expel an

inordinate quantity of laudanum, in a case where the most active emetics, in the largest doses, were resorted to in vain. But most poisons, particularly the corrosive, are attended with so much exhaustion, that it would seem perilous to administer tobacco, lest by its own depressing effects, the powers of vitality might be irrecoverably extinguished. In many instances, however, it appears that it may be administered in small doses with safety and advantage.

We are informed by a respectable writer, that while at the Cape of Good Hope, he had a number of Hottentots, with intermittent fever, under his care. Having few medicines, he resorted to tobacco, and found six grains of snuff as effectual in exciting vomiting, as two of Tartar emetic.

By many it is preferred in minute doses, as a nauseating medicine. Thus administered, it has succeeded in subduing some of the most violent symptoms of the most furious cases of mania; and where it cannot be given by the mouth, from the obstinacy of the patient, it may with equal benefit be applied in the form of a poultice.

As a *cathartic*, tobacco is entitled to notice. 'Some physicians have been in the habit of prescribing this powerful substance not only for the more dangerous cases of incarcerated hernia, but in all cases of obstinate constipation, from whatever cause produced. To relieve these painful diseases, it has been usually given in the form of a clyster, regulating the dose to the age, circumstances and strength of the patient; and it is affirmed to have proved, in many instances, very effectual, and to possess the confidence of practitioners.'

I was informed by a learned and ingenious friend, that, having an obstinate case of ascaris lumbricoides in his own family, after repeated unsuccessful efforts to dislodge the worms, he at last had recourse to this potent remedy, a poultice of which he applied to the region of the stomach. The worms were almost instantaneously expelled, but with very alarming symptoms, and a complete prostration of the patient. From these circnmstances, we should be led to conclude, that its efficacy as a vermifuge depends either upon its narcotic properties, or upon its sudden and powerful effect as a cathartic.

Its effects as a *sternutatory*, that is, as exciting to sneeze, are known to all. If applied to the nostrils, in the form of a powder or snuff, it produces violent and repeated sneezing, with a slight degree of vertigo. The violent agitation produced in this way, together with a copious discharge from the nostrils, often relieves catarrh, headache, and incipient

opthalmia or inflammation of the eyes. But habit soon blunts the sensibility of the organs, and much positive injury follows the habitual use of snuff. It has been a popular remedy in many places for the cure of scald-head, psora, and most other cutaneous eruptions. It has also been applied for cleansing ulcers, and for the removal of indolent tumors. But the dreadful effects produced by it when absorbed into the system, have induced most medical men to abandon it altogether, and prescribe a more safe application.

Though it is said, by Dr. Brailsford, to be a *sudorific* of considerable efficacy, I am in possession of no facts which go to support such a conclusion, unless it be the fact, that it in an eminent degree brings on that cold perspiration of which we have spoken, and which is, in many instances, the immediate precursor of death.

But of all others, its *diuretic* properties have been the most lauded. Dr. Fowler was the first to bring them extensively into notice. In dropsy, dysury, gravel and nephritis calculosa or inflammation of the kidneys, the infusion and tincture were given by him with astonishing success. In spasmodic asthma, the same distinguished physician found it to afford relief.

Mr. Earle, a surgeon of some eminence, has more recently treated several inveterate cases of retention of urine on the same plan and with similar effects, and adds his testimony to its efficacy in testanus, trismus, and other spasmodic affections. Of its power to relieve spasm there can be no doubt. What has been related of its sedative qualities, is abundantly sufficient to establish that fact. Cramps, convulsions, and even the vital principle itself, give away before the exhibition of this deadly narcotic. Hence, to its power of prostrating the muscular enegy, it owes its efficacy in preventing retention of urine.

We have now gone through with an examination of the medicinal properties of tobacco, and have arrived at the following conclusion, viz. that few substances are capable of exerting effects so sudden and destructive, as this poisonous plant. Prick the skin of a mouse with a needle, the point of which has been dipped in its essential oil, and immediately it swells and dies. Introduce a piece of common 'twist,' as large as a kidney bean, into the mouth of a robust man, unaccustomed to this weed, and soon he is affected with fainting, vertigo, nausea, vomiting, and loss of vision. At length the surface becomes deadly pale, the cold sweat gathers thick upon his brow, the pulse flutters or ceases to

beat, a universal tremor comes on, with slight spasms and *other* symptoms of dissolution. As an emetic, few articles can compare with it for the promptness and efficiency of its operation; at the same time there are none which produce such universal debility. As a cathartic, it produces immediate and copious evacuations, with great prostration of strength; but its dose can with difficulty be regulated.

If such be a fair statement of its effects on the human system; if it requires all the skill of the most experienced practitioner to guard against those sudden depressions which uniformly follow its use, when administered with the utmost circumspection; and if, with all this caution, its operation is still followed by the most alarming, and even fatal consequences—what shall we say of those who habitually subject their constitutions to the destructive influence of this worse than 'Bohan Upas?'

To an individual unacquainted with the fact, it would seem incredible that a weed, possessed of properties so poisonous, should ever have been sought as an article of luxury. Yet it has not only been sought, but even credulity startles at the extent to which it has been used. 'Like opium it calms the agitations of our corporeal frame, and soothes the anxieties and distresses of the mind.' Its powers are felt and its fascinations acknowledged, by all the intermediate grades of society, from the sot who wallows in the mire of your streets, to the clergyman who stands forth a pattern of moral excellence, and who ministers at the altar of God. For it the Arab will traverse, unwearied, his burning deserts; and the Icelander risk his life amidst perpetual snows. Its charms are experienced alike, by the savage who roams the wilds of an American forest, and the courtier who rolls in luxury and prescribes rules of refinement to the civilized world; by the miscreant who wrings from the cold hand of charity the pittance that sustains his life, and the monarch who sways his sceptre over half the globe; by him who is bent with woes and years, and him whose cheek is covered yet with boyhood's down. Hence we might conclude it capable of giving strength to the weary, vivacity to the stupid, and wisdom to men void of understanding; capable of soothing the sorrows of the afflicted, of healing the wounds of the spirit, and assuaging the anguish of a broken heart. But how it fulfils these desirable indications, will be our next business to inquire.

Tobacco, as a luxury, has been used for the last two centuries over all the civilized, and the greater portion of the uncivilized world. The modes have been *snuffing*, *smoking*

and *chewing*. Its effects, when habitually used in each of these modes, will now be examined. As far as my observations extend, few, if any, of all the devotees to this stupifying substance, ever resort to its use without some supposed necessity ; and often, alas *too often*, by the advice of physicians.

The benefit to be derived from the exhibition of a medicine in the cure of disease, should not alone induce us to prescribe it, without due regard to the injury which may result to the constitution. Had this rule been observed relative to the subject under consideration, I apprehend the use of this baneful drug would have been less extensive.

Snuff has been prescribed for a variety of complaints, among which are headache, catarrh, and some species of opthalmia, and no doubt sometimes with very good effect ; as I have, in a very few instances, witnessed. But the fact seems to have been overlooked, that its only power to relieve these complaints arises from the copious discharge of mucus from the nostrils, during the violent paroxysm of sneezing which invariably attends its first application ; and that its salutary influence ceases, whenever these peculiar effects cease to accompany its exhibition. Hence in all cases where it is continued an indefinite time, or until the schneiderian membrane loses its sensibility, it not only fails of its medicinal effect, but actually becomes pernicious ; aggravating the very disease it was intended to cure. It not only does this, but goes on committing great ravages on the whole nervous system, superinducing hypocondria, tremors, and premature decay of all the intellectual powers. A thickening of the voice, is also the unavoidable result of habitual snuff-taking. This disagreeable consequence is produced, either by partially filling up the nasal avenues, or by destroying the sensibility of the parts. Be that as it may, we would say of the change, in the forcible language of Cowper : 'O ! it is fulsome, and offends me more than the nasal twang, heard at conventicle from the pent nostril, spectacle bestrid.'

It also occasions loss of appetite, frequent sickness at the stomach, with many other disagreeable symptoms. A case in point, is related by Dr. Cullen, of a woman, who had been in the habit for twenty years. At length she found on taking a pinch before dinner, she had no appetite. This having frequently occurred, she was induced to postpone her pinch till after dinner, when she ate her meal with her accustomed relish, and went on snuff-taking in the afternoon without inconvenience.

Another instance is related by the same author, of the injurious effects of this habit. A lady, who had been accustomed to take snuff freely, was seized with a severe pain in her stomach, which continued unabated notwithstanding many remedies were applied; until accidentally her snuff was omitted for a few days, when the pain was found to subside, and did not return until she again had recourse to her snuff. Then, to her utter astonishment, it immediately came with all its former severity, and would yield to no treatment without a relinquishment of the snuff-box, which (strange to tell) the woman laid aside, and recovered her health.

Most persons in the constant habit of taking snuff, are led on insensibly, until they consume enormous quantities. But as they are accustomed both to its stimulant and narcotic effects, they are not aware of the pernicious consequences. In the midst of interesting conversation, they frequently transcend the bounds assigned them by habit, and the consequence is, sickness, faintness and trembling, with some vertigo and confusion of head. During this paroxysm of snuffing, particles of the powdered tobacco are carried back into the fauces, and thence into the stomach; which occasions not only sickness at the time, but is long after followed with dyspepsia and other symptoms of disordered abdominal viscera.

The second mode of habitually using this drug, is *smoking*. This, too, has been prescribed by reputable members of the faculty. And for what purpose has this disgusting practice been recommended? 'For weakness of the stomach,' to be sure. Persons who have a craving appetite, and consume more food, particularly at dinner, than their stomach will readily digest, experience considerable uneasiness for some time after eating. The mouth and fauces sympathize with the overloaded organ, and an increased quantity of fluid is poured from the mucous follicles and salivary glands, to aid in the process of digestion. Under these accumulating difficulties, the man calls on the '*Doctor*,' who very wisely imagines these symptoms are sufficient evidence that he has a 'weak and watery stomach,' and the pipe and cigar are recommended to carry off the superabundant humors, which still are unable to assimilate the enormous load with which, from time to time, the stomach is crowded. But as the application of the burnt oil of tobacco to the mouth and fauces, from its stimulant and narcotic qualities, benumbs the senses and renders the individual less conscious of his distress, he takes it for granted that he is materially relieved, and knows not, poor man, that it is all delusion. Thus, instead

of taking the only rational method, that of adapting the quantity of food to the powers of digestion, he pursues a course which continues to weaken the organs of digestion and assimilation, and at length plunges him into all the accumulated horrors of dyspepsia, with a complete prostration of the nervous system.

But it has been said that smoking will cure the toothache; and we should have recourse to any means for the removal of so painful a disease. That it will, as a powerful sedative, lessen the pain, and sometimes even altogether remove toothache, is probably true; but why continue the practice after the occasion has ceased? Opium and calomel, judiciously administered, will relieve *cholera morbus;* but whoever thought of making them an article of diet, because from their application he had experienced relief in that dangerous complaint? Or whoever dreamed of using them constantly, lest he might again be attacked with it? Would not prudence dictate to lay them aside, that they might not lose their influence on the system, and consequently their medicinal virtues?

But smoking sometimes diminishes the secretions of the mouth, producing dryness and thirst, instead of moisture; still it is used with the same perseverance as in the former case, and to obviate the same difficulty, an overburdened stomach. And such is the united influence of its stimulant and narcotic qualities, that *the thirst it occasions is not to be allayed by ordinary drinks, but wine, ale and brandy must be taken, to satisfy this unnatural demand.* Hence, smoking has, in many instances, been the sad precursor to the whiskey jug and brandy bottle, which together have plunged their unfortunate victims into the lowest depths of wretchedness and wo.

I am well acquainted with a man in a neighboring county, whose intellectual endowments would do honor to any station, and who has accumulated a handsome estate; but whose habits, of late, give unerring premonition to his friends of a mournful result. This man informed me that it was the fatal thirst occasioned by smoking his cigar, in fashionable society, that had brought him into his present wretched and miserable condition. Without any desire for ardent spirit, he first sipped a little gin and water, to allay the disagreeable sensations brought on by smoking, as water was altogether too insipid to answer the purpose. Thus he went on from year to year, increasing his stimulus from one degree to another, until he lost all control over himself; and now he stands as a beacon, warning others to avoid the same road to destruction.

Smoking has been prescribed for spasmodic asthma, and undoubtedly with some success; and the manner in which it affords relief in this distressing disease has been pointed out, when speaking of the narcotic and antispasmodic effects of this drug. But suppose it capable of relieving the paroxysm, when administered to a person unaccustomed to its deadly stimulus, it will by no means be followed by the same happy effect, when once its use becomes habitual.

But smoking has been the grand resort to secure the system from the influence of contagion; and perhaps no power ascribed to it, has ever been so universally acknowledged. But upon what series of experiments are these pretensions founded? From all the attention which I have bestowed on this investigation, I have been unable to discover any evidence of its utility in this respect, except what arose from the prejudices of the ignorant, or the obstinacy of those who are slaves to the practice of it. The bare assertion of Deimerbroek, 'that it kept off the plague,' without a single corroborative fact, would hardly be sufficient authority on which to establish a conclusion so important; especially when we have the united experience of Rivernus, Chemot and Cullen, to prove the opposite of this position. Hence we conclude, that its properties in keeping off contagion, depend on its sedative powers, which it possesses in common with other narcotics, wine, brandy and opium. As these lessen sensibility, and sometimes allay anxiety of the mind, it is not impossible that in a very few instances they may have prevented the exciting causes of disease from taking effect. But what are these few, when compared with the multitudes whose nervous systems have been destroyed by this pernicious habit, and thus exposed to all the horrors of malignant disease.

Smoking also assuages the *tedium* of life. Here is the grand secret. Man fears to be alone; and when left to his own solitary reflections, he dreads the result of self-examination. He flies for relief to his pipe, his cigar, his quid or his bottle, with the vain hope of escaping from himself. To accomplish an object so desirable, he hesitates not to *stupify* those noble faculties which he cannot hope to extinguish, and with which he has been endowed by the God of nature, for wise and benevolent purposes. And will you, gentlemen, by precept and example, longer sanction *such* a course of conduct,—conduct so degrading to us as intelligent beings, and as conservators of the public health?

The third mode of habitually using tobacco, is *chewing*. In this manner all its deadly powers are speedily manifest

in the commencement of the practice, as has been already shown. In this mode, too, its nauseous taste and stimulant property excite and keep up a profuse discharge from the mucous follicles and salivary glands. Probably to this circumstance alone, is owing the superior efficacy of this mode of using this drug in the cure of toothache. But whether this enormous waste of the secretions of the mouth and fauces can be borne by the constitution with impunity, you, Gentlemen, are abundantly competent to judge. Physiologists agree that these secretions are intended to assist in preparing the aliments for deglutition, by rendering them sufficiently fluid, and afterwards, by their peculiar properties, to promote digestion and assimilation. The great increase of these just before and after eating, and the large quantities swallowed about that time, are unequivocal evidence of their importance to the digestive economy. Then what must be the state of that man's digestion, who, until seated at table, keeps his quid in his mouth, and immediately returns it thither after rising from his meal? And when we reflect, that large quantities of saliva strongly impregnated with this poison, and even particles of the substance itself, are frequently swallowed, what, again I ask, is the probable condition of such a person's digestive organs?

I know it may be said in reply, that such persons often consume large quantities of food, without experiencing any perceptible inconvenience; and I also know that they are often emaciated, notwithstanding the enormous portion of aliment they daily consume. Under these circumstances, the emaciation arises, either from the profuse discharge of saliva, or an imperfect digestion, or the combined influence of both. Hence, when a man of a corpulent habit, with a keen appetite, who is unwilling to forego his wine and to use moderation in his roast beef, applies for professional advice to prevent corpulence, medical men very naturally and philosophically direct him, if he persists in excess, to the use of tobacco, as a temporary relief against the direful effects of his gluttony and intemperance.

A clergyman of high standing informed me, that he acquired the habit of using tobacco in college, and had continued the practice for a number of years; but he found, by experience, his health materially impaired, being often affected with sickness, lassitude and faintness. His muscles also became flabby and lost their tone, and his speaking was seriously interupted by an elongation of the uvula. His brother, an intelligent physician, advised the discontinuance of his tobacco. He laid it aside. Nature, freed from its depressing

influence, soon gave signs of returning vigor. His stomach resumed its wonted tone, his muscles acquired their former elasticity, and his speaking was no more annoyed by a relaxation of them.

A respectable man of my acquaintance, about forty years of age, who commenced chewing tobacco at the age of eighteen, was for a long time annoyed by depression of spirits, which increased until it became a settled melancholy, with great emaciation, and the usual symptoms of that miserable disease. All attempts to relieve him proved unavailing, until he was persuaded to dispense with his quid. Immediately his spirits revived, his countenance lost its dejection, his flesh increased, and he soon regained his health. Another man, who used tobacco very sparingly, became affected with loss of appetite, sickness at stomach, emaciation and melancholy. From a conviction that even the small quantity he chewed was the source of his trouble, he entirely left it off, and very soon recovered.

I was once acquainted with a learned, respectable and intelligent physician, who informed me, that from his youth he had been accustomed to the use of this baneful plant, both by smoking and chewing. At length, after using it very freely while indisposed, he was suddenly seized with an alarming vertigo, which, without doubt, was the result of this destructive habit. This afflicting complaint was preceded by the usual symptoms which accompany a disordered stomach, and a relaxation of nerves, with which, Gentlemen, you are too familiar to need a description here. After the application of a variety of remedies to little or no purpose, he quit the deleterious practice, and though his vertigo continued long and obstinate, he has nearly or quite recovered his former health. And he has never doubted but that the use of tobacco was the cause of all his suffering in this disagreeable disease. Many more cases might be cited, but sufficient has been said to establish the doctrine here laid down.

Having gone through with an examination of the *physical* influence of tobacco, let us now, for a few moments, attend to its *political* and *moral* influence.

1. *It is a costly practice.* The whole adult population in the United States is estimated at six millions, one half of whom are males. Allowing but one half of these to use tobacco in some form, we shall have one and a half millions to be taxed with this consumption. If we take into the account all who are in its use before they arrive at the period of adult age, it would swell the amount to two millions. Lest we should be accused of exaggeration, we will estimate the whole num-

ber of devotees at one million, who pay their daily homage at the shrine of this stupifying idol. The expense to the consumers of this drug varies, according to the quantity and mode of using. Those who are in the habit of smoking freely, and use none but the best Spanish cigars, pay a tax, I am informed by good judges, of not less than fifty dollars a year. While the moderate consumer of Scotch snuff pays from one to two dollars. Somewhere between these wide extremes, may be found the fair estimate of an average cost. If one fifth of the whole number of consumers should pay the highest estimate, it would amount to ten millions annually. Then if three-fifths pay but ten dollars a piece, it will amount to six millions; and if the remaining fifth pay but one dollar each, we shall have two hundred thousand dollars more. These added together will make an aggregate of *sixteen millions two hundred thousand dollars*. In this estimate nothing has been said of another class of consumers, which delicacy forbids me to mention, (and I hope I shall receive their forgiveness for my neglect,) nor of the time wasted in procuring and devouring this precious morsel. But lest even this very moderate calculation should be considered extravagant, which is by many competent judges believed to be far too low, we will reckon the consumers at one million, and the average cost at ten dollars each a year, for the whole; and then we have *the enormous tax of three millions of dollars*, to be aunually paid in these United States for the useless consumption of this loathsome drug.

2. *This practice paves the way to drunkenness.* A few reasons have already been given, why *smoking* tends strongly to favor the introduction of ardent spirits. The dryness of mouth induced in some, is not the only case where a thirst for strong drink is produced. The great waste of saliva, occasioned both by smoking and chewing, has the same dangerous tendency. The fact that few of all the consumers of this plant are fond of those simple beverages so grateful to the unvitiated taste, and that most are inordinately attached to ale, wine and brandy, is sufficient evidence of the dreadful truth, that it is the faithful pioneer to intemperance. What though there are some few and honorable exceptions; and what though there are many, who for a long time have used the poisonous plant, and have escaped the yawning gulf; still a sufficient number have been swallowed up to warrant the general conclusion. The few specifications already made above, might easily be increased a hundred fold.

Though every lover of tobacco is not a slave to rum, yet *almost every drunkard is a slave to tobacco;* and this is indirect

evidence that the habits are in a manner associated, or have a sort of natural affinity. If such be its tendency, what moral responsibility rests upon the man who shall recommend it, either by professional advice, or by his own example! What an infinitude of moral evil *must* follow in its train, if drunkenness be its legitimate effect! What woes, what sorrows, what wounds without cause, may spring into existence at your bidding, when you prescribe the habitual use of this baneful plant! By such a prescription you incautiously open a fountain from which may issue streams, disturbing the peace of private families, pouring the waters of contention into peaceful and harmonious neighborhoods, embittering every condition of life, and poisoning every department of human society.

3. *It is an indecent practice.* To say nothing of the disagreeable contortions of countenance assumed by the great variety of snuffers, smokers and chewers; to say nothing of the pollution, inseparable from these habits, to the mouth, breath and apparel, to the house and its furniture, (all which are too familiar to require description,) I ask, where is the man making any pretensions to refinement, who would not blush to offend the delicate sensibilities of the *fair*, by smoking his pipe or cigar in their presence? True politeness would seem to require, moreover, that even the feelings of *gentlemen* should be respected. But all sense of propriety seems to have fled before the indulgence of this foolish habit. To such an extent has it obtained, that we meet it in the kitchen, in the dining room, and in the parlor; in every gathering of men of business; in every party of pleasure; in our halls of legislation; in our courts of justice; and even the sanctuary of God is sometimes polluted by this loathsome practice. It is impossible to walk the street without being constantly assailed by this noxious vapor, as it is breathed from the mouth of all classes in community, from the sooty chimney sweep to the parson in his sacredotal robe. You can scarcely meet a man in the street, with whom you have business, but he pours a stream of smoke into your face, exceedingly disgusting. And this he does too, without imagining that he transgresses the rules of politeness, or gives you any cause of offence.

In these habits we resemble the *Aborigines* of our country. They load their huge pipes with the dried leaves of this plant, and when lighted, they breathe the dark cloud of smoke from their mouth and nostrils, and as it curls around their head, ascending towards heaven, they present it as an offering to appease the anger of the Great Spirit. A mutual influence has resulted from our intercourse with the Indian. We have

taught him how to debase himself below the brute, and destroy the quiet of savage life by the use of our *whiskey;* and he, in return, has taught us to destroy our constitutions, and interrupt the harmony of civilized society, by the habitual use of his deadly narcotic.

Gentlemen, I have done. The subject, with a slight examination, is before you. I have plainly and fearlessly expressed my opinion, without intending to wound the feelings of a single individual. If your sentiments correspond with mine, you will assist in bringing this odious practice to the bar of public opinion. There let it be subjected to a severe, but dispassionate trial; and if on a cool and deliberate investigation, its pernicious tendency shall fully appear, then let the American people rise up, and with united voice pronounce its sentence of final condemnation.

McAllister's Dissertation on Tobacco.

SASSAFRAS.

Laurus sassafras.

Fig. 1. A leaf. Fig. 2. The fruit.

The Sassafras, on account of its medicinal virtues and the beauty of its foliage, is one of the most interesting trees of the American forests. In the United States, the neighborhood of Portsmouth in New Hampshire, in the latitude of 43°, may be assumed as one of the extreme points at which it is found towards the north-east: in the Western Country it is met with one degree farther north. From Boston to the banks of the Mississippi, and from the shores of the ocean to Virginia, and to the remotest wilds of Upper Louisiana beyond the Missouri, comprising an extent in each direction of more than 1800 miles, this tree is sufficiently multiplied to

be ranked among the most common trees. It is seen growing on lands of every description, from the dry and gravelly to the most moist and fertile, with the exception of such as are arid and sandy to excess, like the *pine-barrens* of the Southern States: neither is it found in the swamps that border the rivers by which these states are watered.

This tree attains its greatest developement on the declivities which skirt the swamps, and such as sustain the luxuriant forests of Kentucky and West Tennessee, where it arrives to the height of 50 or 60 feet, with a proportionate diameter. The bark which covers old trees is of a grayish color, and is chapped into deep cracks. On cutting into it, it exhibits a dark dull red, a good deal resembling the color of the Peruvian bark. The bark of the young branches is smooth and of a beautiful green color. The old trees give birth to hundreds of shoots which spring up at little distances, but which rarely rise higher than six or eight feet. The leaves of the sassafras are four or five inches in length, alternate, and petiolated. At their unfolding in the spring they are downy and of a tender texture. They are of different shapes upon the same tree, being sometimes oval and entire, and sometimes divided into lobes, which are generally three in number, and which are rounded at the summit. The lobed leaves are the most numerous, and are situated on the upper part of the tree. About New York and Philadelphia this tree is in full bloom in the beginning of May, and six weeks earlier in South Carolina. The flowers unfold before the leaves, and appear in small clusters at the end of the last year's shoots. They are of a greenish yellow hue, and are but slightly odoriferous. In this species of laurel the sexes are confined to different stocks. The fruit or seed is of an oval form, and of a deep-blue color, and is contained in small, bright, red cups, supported by peduncles from one to two inches in length. These seeds, when ripe, are eagerly devoured by the birds, and soon disappear from the tree.

The wood of this tree is not strong, and branches of considerable size may be broken with a slight effort. In the young tree the wood is white; in those which exceed fifteen or eighteen inches in diameter it is reddish and of a closer grain. It is not, however, in these respects to be compared with the oak and hickory. Experience shows, that this wood, stript of its bark, resists for a considerable period the progress of decay; and it is on this account employed for the posts and rails of rural fence. It is also sometimes used for the joints and rafters in houses built of wood. It is said to be

secure from the attack of worms: this advantage is attributed to its odor, which it preserves as long as it is sheltered from the sun and rain. Bedsteads made of it are said to be never infested with insects. But for these purposes the sassafras wood is not in habitual use, and is only occasionally employed. For fuel, it is held in little esteem, and it is only in the cities of the Southern States, which are not, like those of the north, abundantly furnished with fuel, that it is brought into the market: it is considered as wood of the third quality. Its bark contains a considerable portion of air, and snaps while burning like that of the chesnut.

The medicinal virtues of the sassafras are so well proved, that during more than two hundred years, since its first introduction into *materia medica*, it has maintained the reputation of an excellent sudorific, which may be advantageously employed in cutaneous affections, in chronic rheumatism, and in siphilitic diseases of long standing. In the last case it is always joined with lignum vitæ and sarsaparilla. The wood is slightly aromatic and somewhat acrimonious, depending on a resin and an essential oil, but the smell and taste which are peculiar to the vegetable are more sensible in the young branches, and incomparably more so in the bark of the roots; this part of the tree therefore should always be preferred, for the wood appears to contain but a small degree of the qualities assigned it, and even this it loses after being long kept. From the bark of the roots, which is thick and sanguineous, the greatest quantity of essential oil is extracted: this oil, after long exposure to the cold, is said to deposit very beautiful crystals. The flowers of this tree when fresh have likewise a weak aromatic odor. A great number of people in the United States consider them as stomachic and efficacious in purifying the blood; and for this purpose, during a fortnight in the spring, they drink an infusion of them with a little sugar, in the manner of tea. The dried leaves and the young branches contain a mucilaginous principle nearly resembling that of the ochro. They are used by some people to thicken their pottage. An agreeable beverage may be made by boiling the young shoots in water, to which a certain quantity of molasses is added, and the whole is left to ferment: this beer is considered as a very salutary drink during the summer. Mucilage of sassafras pith is peculiarly mild and lubricating, and has been used with much benefit in dysentery and catarrh, and particularly as a lotion in the inflammatory stages of the ophthalmia. But except as a diaphoretic the powers of sassafras are very doubtful. It certainly has no antisyphilitic properties.—*Sylva Americana.*

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR FEBRUARY, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	19	28	24	30.38	30.38	30.40	Fair	Fair	Cloudy	N. W.	N. W.	N. W.	
2	29	40	38	30.20	30.00	30.00	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	0.06
3	40	50	38	29.95	29.98	30.00	Fair	Cloudy	Rain	S. W.	S. W.	N. E.	
4	32	35	30	29.98	30.02	30.05	Cloudy	Cloudy	Snow	N. E.	N. E.	N. E.	0.16
5	28	24	14	29.95	29.90	30.02	Snow	Snow	Fair	N. E.	N. E.	N. W.	0.65
6	4	16	18	30.30	30.35	30.20	Fair	Fair	Snow	N. W.	N. W.	N. W.	
7	24	30	18	30.05	30.12	30.30	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	0.04
8	17	24	18	30.39	30.40	30.04	Cloudy	Cloudy	Cloudy	N. W.	N. E.	N. E.	
9	24	24	14	30.35	30.20	30.08	Snow	Snow	Snow	N. E.	N. E.	N. E.	
10	14	30	17	30.02	30.09	30.30	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	1.15
11	17	30	31	30.49	30.49	30.27	Fair	Fair	Cloudy	N. W.	S. E.	S. E.	
12	43	44	49	29.95	29.90	29.70	Cloudy	Cloudy	Rain	S. W.	S. W.	S. W.	
13	35	35	27	29.95	30.20	30.48	Fair	Fair	Fair	N. W.	N. W.	N. W.	0.67
14	27	34	30	30.58	30.59	30.55	Cloudy	Cloudy	Cloudy	N. E.	E.	N. E.	
15	30	24	27	30.49	30.30	30.40	Snow	Cloudy	Fair	N. E.	N. W.	N. W.	0.06
16	18	19	8	30.50	30.56	30.58	Fair	Fair	Fair	N. W.	N. W.	N. W.	
17	4	19	20	30.58	30.55	30.20	Fair	Cloudy	Cloudy	N. W.	N. W.	S. W.	
18	26	34	32	29.85	29.90	29.92	Cloudy	Cloudy	Cloudy	S. W.	S. W.	N. E.	
19	34	34	30	29.86	29.80	29.75	Rain	Rain	Rain	E.	E.	N. E.	0.67
20	30	33	32	29.76	29.77	29.51	Rain	Rain	Hail	N. E.	N. E.	N. E.	
21	18	27	16	29.91	30.00	30.25	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	1.19
22	10	26	25	30.49	30.50	30.50	Fair	Fair	Fair	N. W.	S. W.	S. W.	
23	31	36	32	30.35	30.20	30.10	Snow	Rain	Cloudy	S. W.	S. W.	S. W.	0.46
24	10	7	6	30.49	30.62	30.65	Fair	Fair	Fair	N. W.	N. W.	N. W.	
25	8	22	20	30.58	30.40	30.22	Cloudy	Cloudy	Rain	N. W.	N. E.	N. E.	0.22
26	24	35	30	30.15	30.15	30.15	Cloudy	Fair	Fair	N. W.	W.	S. W.	
27	21	36	30	30.25	30.30	30.28	Fair	Fair	Fair	N. W.	S. W.	S. W.	
28	32	35	32	30.30	30.05	30.00	Cloudy	Rain	Cloudy	S. E.	E.	E.	0.20
29	32	42	30	30.00	30.10	30.30	Fair	Fair	Fair	S. W.	N. W.	N. W.	

Depth of water fallen, 5.53 inches.

Hours of observation, at sunrise, 1 o'clock and 10 P. M.

Pendleton's Lithog.s Boston

THE NATURALIST.

MAY, 1832.

THE OLIVE TREE.

Olea europæa.

THIS ornament of the vegetable kingdom, which is called by Columella, the first among trees, has constituted from the remotest antiquity, the pride of some of the most celebrated regions of the globe; and, aside from the commercial value of its products, it is invested, both by sacred and profane history, with a thousand interesting associations.

Of this tree we have very ancient mention, since it is related in the book of Genesis, that the dove which Noah sent out of the ark, returned with an olive leaf in its mouth, by which he knew that the waters of the deluge had abated. Since that time the olive branch has been used as an emblem of peace by all civilized nations; and it is observed that a green bough answers the same purpose among the most savage people in every part of the globe.

That the olive tree was anciently very much esteemed by the Hebrews, is proved by the parable of Jotham:—' *The trees went forth on a time to anoint a king over them; and they said to the olive tree, reign thou over us. But the olive tree said unto them, should I leave my fatness, wherewith by the honor of God and man, and go to be promoted over other trees?*' David also seems to have considered the olive as a blessing, when he says ' *Thy children, like the olive branches round about thy table: Lo! thus shall the man be blessed that feareth the Lord.*'

The Grecians appear to have thought no less of this tree and of its fruit, than the Israelites. In their fabulous histories, we are informed that the gods having been called on to settle a dispute

between Neptune and Minerva, arising from the desire of each of them to give a name to the new city of Cecrops; they determined to give the preference to the one who should produce the most beneficial gift to mankind. Neptune, striking the ground with his trident, created a horse; but Minerva, by causing an olive tree to spring from the earth, gained her point, and from her was the city called Athenæ, now Athens; since, the olive, the emblem of peace or agriculture, was much preferred to the horse, the symbol of war and bloodshed. Minerva and the Graces are also represented as crowned with olive branches.

A contribution of olives was given by all the Grecians who attended the *Panathenœa*, a festival held at Athens in honor of Minerva. Those who excelled in any of the games during this festival, were crowned with a wreath of olives, which grew in the grove of Academus, a place near the city, with spacious and shady walks, belonging to a man of that name. Plato having here opened a school of philosophy, all places of learning have been since called *Academies.*

As to the native country of the olive, we may conclude, from several passages in scripture, that it grew naturally in Syria; but particularly near Jerusalem, if we may judge by the 'Mount of Olives,' so often mentioned in the New Testament. It was first planted in Italy, in the thirteenth year of the reign of Servius Tullis, the sixth king of Rome; and in that very year was Nebuchadnezzar restored to his understanding and his kingdom, after having spent seven years among the beasts of the field.

The olive seems to have been highly appreciated by the Romans; as Pliny says, 'except the vine, there is not a tree bearing fruit of so great account as the olive.' Fenestella informs us, continues this author, 'that during the reign of Tarquenius Priscus, which was about the 183d year from the foundation of Rome, there were no olive trees, either in Italy, Spain, or Africa, which is a strong presumption that they grew originally only in Syria.' Theophrastus states that in the 440th year of the city, there were no olive trees in Italy, but on the coast, and within forty miles of the sea; but Pliny says, in his time, they were to be found in the very heart of Spain and France, but that the olives of Syria, although smaller, produces the best oil. Virgil mentions but three kinds of olives. Columella mentions ten varieties, but says, he believes they were much more numerous.

In the olive yards of France, the olive tree generally attains the height of eighteen or twenty five, with a diameter of six inches to two feet. It ramifies at a small height, and forms a compact rounded summit. The foliage is of a pale, impoverished verdure,

and the general appearance of the tree is not unlike that of a common willow which has been lopped, and which has acquired a new summit of three or four years, growth. Indeed the olive possesses neither the majesty of forest trees, nor the gracefulness of shrubbery. It clothes the hills, without adorning them, and, con sidered as an accident of the landscape, it does not charge the picture sufficiently to contribute greatly to its beauty. The rich culture for which the southern provinces of France are celebrated, is less conducive to rural beauty than some of the humbler species of husbandry. The richest country is not always the most lovely; a country of mines, for example, is usually ungracious to the eye; and the olive is called by an Italian writer, a mine upon the surface of the earth.

The main limbs of the olive are numerously divided; the branches are opposite, and the pairs are alternately placed upon conjugate axes of the limb. The foliage is evergreen, but a part of it turns yellow and falls in the summer, and in three years it is completely renewed. In the spring or early autumn, the seasons when vegetation is in its greatest activity, the young leaves put forth immediately above the cicatrix of the former leaf stalks, and are distinguished by their suppleness, and by the freshness of their tint. The color of their leaves varies in the different varieties of the olive, but they are generally smooth, and of a light green above, whitish and somewhat downy, with a prominent rib beneath. On most of the cultivated varieties they are from fifteen lines to two inches long, and from six to twelve lines broad, narrow, with both ends acute, even and whole at the edge, placed immediately on the main stem without a foot stalk, opposite and alternate in the manner of the branches.

The olive is slow in blooming, as well as in every function of vegetable life. The buds begin to appear about the middle of April, and the bloom is not full before the end of May, or the beginning of June. The flowers are small, white, slightly odoriferous, and disposed in axillary *racemes* or clusters. A peduncle about as long as the leaf, issues from its base, upon which the flowers are supported by secondary pedicles, like those of the common currant. Sometimes the clusters are almost as numerous as the leaves, and garnish the tree with wanton luxuriance; at others they are thinly scattered over the branches, or seen only at the extremity. It is essential to remark, that they are borne by the shoots of the preceding year. Each flower is complete in itself, consisting of a calyx, a monopetalous corolla divided into four lobes, and in the organs of reproduction, namely, two stamens and one pistil.

A week after the expanding of the flower, the corolla fades and falls. If the calyx remains behind, a favorable presage is formed of the fruitfulness of the season: but the hopes of the husbandman are liable to be blasted at this period, at the slightest intemperateness of the elements, which causes the germ to fall with the flower. Warm weather, accompanied by gentle breezes that agitate the tree and facilitate the fecundation, is the most propitious to his wishes.

The fruit of the olive is called by botanists, a *drupe*. It is composed of pulpy matter enveloping a stone, or ligneous shell, containing a kernel. The olive is egg-shaped, pointed at the extremity, from six to ten lines in diameter, in one direction, and from ten to fifteen lines in the other; on the wild tree, it hardly exceeds the size of the red currant. The skin is smooth, and, when ripe, of a violet color; but in certain varieties, it is yellowish or red. The pulp is greenish, and the stone is oblong, pointed and divided into two cells, one of which is usually void. The oil of the olive is furnished by the pulp, which is a characteristic almost peculiar to this fruit; in other oleaginous vegetables, it is extracted from the seed. The young olives set in June, increase in size, and remain green through the summer, begin to change color early in October, and is ripe at the end of November, or in the beginning of December. On the wild olive, five or six drupes are ripened upon each peduncle; but on the cultivated tree a great part of the flowers are abortive, and the green fruit is cast at every stage of its growth, so that rarely more than one or two germs upon a cluster arrive at maturity.

On the branches of the olive, and on the trunk of the young, tree the bark is smooth, and of an ashy hue. When the epidermis is removed, the cellular integument appears of a light green. On old trees, the bark upon the trunk, and upon the base of the principal limbs is brown, rough and deeply furrowed. In the spring and autumn, when the sap is in motion, the bark is easily detached from the body of the tree. The wood is heavy, compact, fine-grained and brilliant. The alburnum is white and soft, and the perfect wood is hard, brittle and of a reddish tint, with the pith nearly effaced as in the box wood. It is employed by cabinet makers to inlay the finer species of wood which are contrasted with it in color, and to form light ornamental articles, such as dressing cases, small boxes, *&c*. The wood of the roots, which is more agreeably marbled, is preferred. The olive was classed by the ancients, among the hard and durable species of wood, such as the ebony, the cedar, the box, the lotus. On account of its hardness, it was used for the hinges of doors, and before metal

became common in statuary, it was selected by the Greeks for the images of their gods. Three statues of Minerva were preserved in the citadel of Athens, which exemplified the progress of this admirable art; the first, made of olive wood, and of rude workmanship, was said to have fallen from heaven; the second, of bronze, was consecrated after the victory of Marathon; the third, of gold and ivory, was one of the miracles of the age of Pericles. From its resinous and oleaginous nature, the olive wood is eminently combustible, and burns as well before, as after it is dried. The value of its fruit renders this property unimportant. This tree may be multiplied by all the modes that are in use for the propagation of trees and requires but little care in the cultivation, and produces fruit once in two years. This fruit, the modern Greeks, during Lent, eat in its ripe state, without any preparation, but a little pepper, or salt and oil.

We receive it from the south of France, from Spain and Portugal, pickled in the following manner. It is gathered unripe, and suffered to steep in water some days, and is afterwards put into a lie of water and barilla, or kali, with the ashes of olive stones, or with lime. It is then bottled or barrelled with salt and water, and in this state do we meet with it at the deserts of our most wealthy tables, where fashion has done much in having introduced and given a fondness for olives, which seems to be an acquired taste; however, they are grateful to the stomach and are considered good to promote digestion and appetite.

But olives are chiefly cultivated for the sake of the oil that they produce, which is not a profitable article of commerce, but forms a principal one of food to the inhabitants of the places where these trees are found. This oil is contained in the pulp only, as before observed, whereas other fruits have it in the nut or kernel. It is obtained by simple pressure, in the following manner. The olives are first bruised by a millstone, and afterwards put into a sack, and then into the trough of a press, for the purpose, which, by means of turning a strong screw, forces all the strong liquor out, which is called *virgin oil.* It is received in vessels half filled with water, from which it is taken off, and set apart in earthen jars. Several coarser kinds are obtained afterwards, by adding hot water to the bruised fruit.

The oil of olive seems to have been of great utility to the ancients, since Aristæus, son of Apollo, by Cyrene, was regarded as a rural deity, for having taught mankind to extract it, and also to make honey, cheese and butter. The wrestlers were anointed with it; and it was made a substitute for butter, which among the Romans was used as a medicine.

We find in the book of Leviticus, that oil formed a principal part of the meat offerings, which the Israelites presented to the Lord, '*If thou bring a meat offering baken in the oven, it shall be unleavened cakes of fine flour, mingled with oil, or unleavened wafers, anointed with oil. And if thy oblation be a meat offering, baken in the fryingpan, it shall be made of fine flour with oil.*'

Pliny informs us, that in the 500th year of the city, when Appius Claudius and L. Junius were consuls together, a pound of oil was sold for twelve asses; but that in the year 680, ten pounds of oil sold for one ass, and that in twenty-two years after that time, Italy was able to furnish the provinces with oil; and it was much used at their baths, having, as they supposed, the property of warming the body and defending it against the cold.

The best olive oil, at present, is obtained from Provence. It is esteemed good for the breast and lungs; it tempers the sharp choleric humors in the bowels, and is useful against all corrosive mineral poisons, as arsenic, lead, *&c*.

Thus have we rapidly sketched an outline of the history and uses of the far-famed olive. Among the gifts of Minerva which adorn our rising republic, policy, arts and arms, may we hope to see her favorite tree enrich our soil. Some light may be thrown upon this inquiry, by an examination of our climate, but it can be resolved only by experience.

The eastern and western shores of the Atlantic Ocean differ essentially in the phenomena of climate. In Europe, the distribution of heat through the seasons, is more uniform, and the medium of the year more elevated. This equability is highly favorable to the perfection of vegetation; hence that of America is meliorated in the corresponding one in Europe, while many productions of that country cannot exist under the same parallels in America. We are obliged, also, to migrate in the train of the seasons in quest of an agreeable temperature, which the most favored Europeans enjoy without changing their native signs. We experience, in the same latitude, the summer of Rome, the winter of Copenhagen, and the mean temperature of the coast of Britain. Nor is this difference attributable to the state of cultivation, nor to any accidental cause with which we are acquainted. In the eternal forests which shroud our north-western coast, we find again the delicious climate of Europe, while Tartary and China repeat the phenomena of our own. For the enjoyment of life, and for the richness of agriculture, we should have been more advantageously situated on the opposite side of the continent.

The olive requires a climate whose mean temperature is equal to 57° 17′, and that of the coldest month to 41° 5′. In the Uni-

ted States, where the mean temperature of the year is 57° 17′, that of the coldest month is only 0° 5′, with some days far more intense. The capriciousness of our climate is still more dangerous to delicate vegetables, than its inclemency; the difference of temperature in a single day is almost equal to that of the whole year in the south of Italy. The olives near Charleston, South Carolina, are rendered barren by the vernal frosts which congeal the young shoots. In a more southern latitude they would be secure in the winter, but they would languish through a sultry summer, unrefreshed by the healthful breezes which they respire on the shores of the Mediterranean Sea; they would, besides, find a silicious, instead of a calcareous soil.

Notwithstanding these obstacles, tracts, uniting the conditions necessary for the growth of the olive, may probably be found sufficiently for our own wants. The possibility of its flourishing on our shores, has been demonstrated by several experiments; one in particular which we shall relate. While the Floridas were held by the English, an adventurer of that nation led a colony of Greeks into the eastern province, and founded the settlement of New Smyrna: the principal treasure which they brought from their native clime, was the olive. Bartram, who visited this settlement in 1775, describes it as a flourishing town. Its prosperity, however, was of momentary duration; driven to despair by hardship and oppression, and precluded from escape by land, where they were intercepted by the wandering savages; a part of these unhappy exiles conceived the hardy enterprize of flying to the Havanna in an open boat; the rest moved to St. Augustine, when the Spaniards resumed possession of the country. In 1783, a few decaying huts and several large olives, were the only remaining traces of their industry.

Louisiana, the Floridas, the islands of Georgia, and chosen exposures in the interior of the state, will be the scene of this culture. Perhaps it will be extended to some parts of the Western States; it has been hastily concluded that the olive can exist only in the vicinity of the sea; it is found in the centre of Spain, and in Mesopotamia, at the distance of a hundred leagues from the shore. The trial should be made in every place where its failure is not certain, and for this purpose, young grafted trees should be obtained from Europe, and the formation of nurseries from the seed immediately begun.

The olive is perhaps the most valuable, but it is not the only accession that might be made to our vegetable reign, if a more enterprising spirit prevailed in our husbandry, and if establishments were formed for the reception of exotic plants. This im-

portant subject claims the attention of government. Amidst its labors for the promotion of commerce and manufactures, why should not its fostering care be extended to agriculture?

The people of the United States, instructed by experience, have consecrated an altar of oblivion to the genius of the waves, and to the genius of the soil. They will not allow one system of industry to be promoted at the experience of another. We have solved transcendant problems of reconciling the interest of the individual with that of the public, by throwing down the barriers to *every* species of industry, and by leaving every man to enjoy the fruits of his labor, undiminished by the exactions of a rapacious government. Let these principles be the immovable basis of our political economy. The height of prosperity at which we have arrived, is doubtless attributable to the successive enterprizes of our merchants, and our commerce should still be cherished and defended like the sacred soil of the republic. But has not the moment arrived when we may begin to measure the greatness of our country by some other standard than simply that of commercial prosperity? With means so ample and unembarrassed, might we not give more activity and extension to works of domestic improvement? Education remains to be perfected—a national character to be formed—our strength to be established on durable foundations, by the developement of our internal resources. Institutions should be devised, which, by assimilating the feelings of our citizens, may corroborate that union which is the bulwark of our national independence, without intrenching on those subordinate sovereignties which are the guarantees of our political liberty. A taste for pacific glory should be inspired, and an impulse given to public spirit, in harmony with that magnanimous moderation which becomes the future arbiter of nations.

From these great objects no schemes of vulgar ambition should for a moment divert our ardor. Already the influence of our character far exceeds that of our strength, and our claims to the rank of a primary power are admitted by anticipation. The attention of the world is daily becoming more intently fixed upon our actions. Old Europe contemplates with reverent affection, as the hoary-headed warrior gazes on the blooming hero whose youthful achievements eclipse the glory of his sire. A great example is wanted by mankind; from us they demand it; and the cause of universal liberty is interested in our conduct.

We do not utter these sentiments in the language of reproach. Much has already been done by our counry, which is admired by contemporary sages, and which will go down with honor to a more enlightened and philosophical posterity; all that is great and

good may be hoped from her maturer wisdom. Our fathers have left us a noble inheritance, and it is our duty to improve it. What surer basis can we choose for national wealth, than a learned and enterprising agriculture? How can we more effectually strengthen the ties of interest that bind the extremities of our country in indissoluble union, than by augmenting the number and the value of their useful productions? How can the intelligence of a people be more favorably developed, than by an art which gives so wide a scope to comparative sagacity, and which brings its conclusions to the tests of immediate experience? Who are more likely to be devoted to their country, than those who have attached the hopes of their children to its soil?—There is, besides, in the profession of agriculture, something so congenial to republican manners, that we should naturally expect to see the freest country the best cultivated. Remote from the contest of sordid passions, and surrounded by all that is necessary to his happiness, the husbandman has no inducement to calculate the interest upon political corruption. An active life, spent in the open air, in the majestic presence of Nature, lends a corresponding simplicity and elevation to his character. In public stations a patriot is often driven from his purpose, by the jealous opposition of his rivals, or by the invincible prejudices of his age; he must at least, sacrifice his freedom to the duties of his office; but in a life devoted to agricultural improvement, the purest sources of rational enjoyment are united; the first want of a generous spirit, is that of being useful to mankind; the second, is that of *liberty*.

PLATE V.

A branch and fruit of the natural size. Fig. 1. Flowers of the natural size. Fig. 2. A flower magnified. Fig. 3. A drupe with the stone exposed.

CONCHOLOGY.

NO. III.

Of the Formation of Shells. The shell or covering of testaceous animals, has been considered in some measure as analagous to the bones of other animals, although its formation and growth are very different; since it serves as a base or support to the muscles, which are attached to its internal surfaces. The

principal use of the shell, however, is to serve as a covering or defence of the animal.

Testaceous animals are not only extremely different in external form, but also in the mode of their production. Some are viviparous, as most of those which inhabit bivalve shells, multivalves, and even some of the univalves; while the others, which form the far greater proportion, are oviparous. In one point, however, they all agree, that whatever be the mode of production, whether from an egg, or directly from the uterus of the mother, the shell is formed on the body of the young animal, and is proportioned to its bulk.

The best observations which have yet been made, and the most elaborate investigation which has hitherto appeared, concerning the formation and developement of shells, are those of the celebrated Reaumur, which were published in the memoirs of the Academy of Sciences for the year 1709. The same subject has been prosecuted by other authors, but their results have been nearly the same as those of this distinguished naturalist. Klein is almost the only author who has advanced a different opinion.

In his dissertation concerning the formation of shells, he charges Reaumur with supporting the opinion, that testaceous animals, when they proceed from eggs, are not furnished with the shell, but that it is formed after being hatched. This opinion, indeed, has been ascribed to Reaumur by the historian of the academy, who, in the analysis of his excellent memoir of the formation of shells, has observed, 'that hitherto the curious have been struck with the prodigious variety, the exact regularity of structure, the singular beauty and splendor of color of shells; but naturalists have been less attentive in studying and investigating the mode of their formation.' They seem to have thought that although shells, as well as the covering of crustaceous animals, are bones placed externally to the animals which they cover, it was necessary to consider them as parts of their bodies, and to include this inexplicable circumstance under that of the general formation of animals, which is incomprehensible to the human mind. They have therefore supposed that the animal and its shell proceeded from the same egg, and were developed together; and they have rested satisfied in admiring the economy of nature in providing so elaborate a covering for so low an order of animals. But this supposition, although probable, is not founded on truth. The animal only, not the shell, is produced from the egg. The discovery of this fact is owing to Reaumur.'

It must seem very extraordinary, that such an error should have crept into the abstract of the memoir of this celebrated philoso-

pher, who in the course of it has clearly expressed a contrary opinion. 'I have frequently,' says Reaumur, 'compared the shells of snails which are just hatched, and even with those which I had taken from the eggs before they were hatched, with other shells of full grown snails of the same species, with which I had left only the same number of whorls of the spire with the same shells, and then they appeared in all respects the same.' He farther observes, 'that what has been said with regard to the increase of shells, renders it unnecessary to enter into the detail of their original formation; for it is easy to conceive, that when the body of a small embryo which is one day to fill a large shell, has arrived at a certain state, in which the different teguments in which it is included, have sufficient consistence to secrete from their pores the peculiar fluid which is destined to the formation of the shell, this fluid may be deposited on the surface, may thicken, and at last become firm and solid.' And thus commences the formation of the shell, in the same way as its increase is continued. Snails do not proceed from the egg, without being previously furnished with this shell, which then has one turn and little more of the spire.

When the eggs of testaceous animals are hatched, the young appears with its shell already formed, and according to the observations of Reaumur, it has then one complete turn of the spire and a little more; but at that period the shell is extremely thin. It seems probable that the formation of the shell is posterior to that of the principal organs of the animal, as the bones in the fœtus of other animals are formed after the brain and the heart.

Reaumur has suspected that the shell is the last formed, and if proofs are wanting to establish this fact, it is certain that at particular periods, if the eggs of testaceous animals are opened, the external parts of the embryo are found already developed, without any appearance of the shell. But whatever may be the period of the formation of the shell, it may be received as an established fact, that the animal is furnished with it at the time it leaves the egg. Leuwenhoek first observed this fact with regard to oysters; the same observation was afterwards made by Lister, and extended to others, both land and river shells. This observation has been confirmed by other naturalists, and particularly by Rumphius, Swammerdam, Reaumur and Adanson. From the investigations of the latter, it appears, that although there are many of the marine testaceous animals which are viviparous, they resemble those which are oviparous, in being furnished with the shell when they separated from the parent.

Since then it appears, that the shell of testaceous animals is

completely formed previously to the developement of the animal; and that it may be considered as an essential part of its organization, let us now inquire into the mode by which its growth is effected. According to the decisive experiments of Reaumur, the enlargements of shells is owing to a juxta-position, or successive additions of earthy and animal matter, independent of any organized structure. Klein has supported a contrary opinion, and supposes that the growth of shells is effected by intur-susception or a kind of circulation. The opinion of Reaumur, however, has most generally prevailed. Excepting Bonnet, few naturalists have adopted that of Klein; and it will appear that this celebrated naturalist was led to entertain concerning the mode of the formation of shells, by the experiments of Herissant on the generation of bone and shell. From these experiments it was clearly demonstrated, that shells are composed of two substances, the one a membranaceous or animal substance, and the other an earthy matter; but no such conclusion can be drawn from them in support of the opinion, that the shell is a continuation of the body of the animal; or that it is as closely connected as the bones in the bodies of other animals; or even that this connection is formed by means of fibres of the ligament which attaches the animal to its shell; for it has been shown, that these muscular or ligamentous fibres, in all descriptions of testaceous animals, are successively separated, in proportion to the increase or enlargement of the shell. This could not possibly take place, if the evolution and formation of the shell, according to the opinion of Herissant, depended on an internal circulation, analagous to what happens in the body of the animal. In this case, the vessels which proceed from its body, having no longer a communication with those which are supposed to exist in the shell, it would be deprived of nourishment, and consequently could not increase in size. And it is found, that this separation takes place in all shells. It is gradually completed as the growth of the shell advances.

A body may increase in volume in two different ways. Either the particles of which it is composed pass through that body by means of circulation, and undergo certain changes by which they are prepared to form part of the body, or the particles of which a body is composed, may unite with it by juxta-position, without any previous circulation or preparation within the body, to the increase of which they are destined. It is in the first way, that the growth of vegetables and animals is accomplished; the second is the mode by which shells receive new additions of matter, and enlarge in size. The first is the mode of increase peculiar to living, organized substances; by the second, inorganized substances

receive new additions of matter, and increase in volume, These indeed afford sufficient characteristic marks for a natural division of bodies into two classes, namely, organized, and inorganized substances.

The experiments of Reaumur have decisively proved, that the growth of shells is owing to the latter mode of increase. These experiments were made not only on sea shells, but also on land and river shells; on univalves and bivalves; and, in all, the result was invariably the same. In conducting these experiments, he inclosed the shells, on the progress of which he made his observations, in boxes pierced with small holes so as to admit the water, but so small as to prevent the egress of the animal. These boxes were sunk in the sea, or the river, and in this way he was enabled to watch the process of the growth of the shell. He first observed, that when the animal, which exactly fitted its shell, began to increase its size, the shell in a short time, not being sufficiently large to cover its whole body, part of it was naked or unprotected. This part of the animal must always be towards the opening of the shell, because the shell being previously completely filled, it cannot extend in any other direction. All animals which inhabit shells of a spiral form, such as the snail and volute, can only extend at the head, or the opening of the shell; whereas the animals in bivalve shells, such as the muscle and the oyster, may enlarge in their whole circumference. In all the species of testaceous animals, it is this part which appears by the increase of the animal when it enlarges the shell. This increase takes place, according to Reaumur, by the following mechanism.

It is a necessary effect of the laws of motion, when liquids run in canals, that the small particles of these fluids, or the small foreign bodies mixed with them, which on account of their figure, or their less degree of solidity in proportion to their surface, move slower than the others, fly off from the centre of motion, and approach towards the sides of these canals. It even frequently happens, that these small particles attach themselves to the internal surface of these canals or tubes, and form concretions of different degrees of thickness. It is besides certain, that the fluids which circulate in these tubes, press against their sides on every point of their interior surface; so that if they were pierced with a number of small holes of sufficient diameter to give passage to the small particles of matter floating in these fluids, these particles would be deposited on the external surface where a crust would be formed similar to that of the inside; with this difference, that it would become thicker and more solid, being less exposed to the friction of the fluid, than that which is deposited in the interior of the tube.

To a similar mechanism Reaumur ascribes the increase of shells. The external surface of that part of the body of the animal which has extended beyond the limits of the old shell, is furnished with a great number of canals, in which circulate the necessary fluids for the nutrition of the animal. A great many small particles of a viscid and earthy matter are mixed with these fluids. Now, as these particles are less fluid than those of which the liquids themselves are composed, they approach the sides of the vessels, which are themselves furnished on that side of the external surface of the body of the animal, with a great number of pores, which allow them to escape from the vessels, so that they are deposited on the external surface of these tubes, or rather in that body of the animal itself, which is uncovered by the shell.

These particles of earthy and viscid matter having reached the surface of the body of the animal, readily unite with each other, and with the extremity of the old shell, especially when the excess of moisture is dissipated; and thus by their union they compose a small solid body, which is the first layer of the new addition. Other particles of similar matter continuing to escape in the same way from the excretory vessels of the animal, form a second layer from the first; afterwards a third, and a fourth, or more till the new part of the shell has acquired sufficient consistence and thickness. It is however observed to continue thinner for a certain time than a former opening, till the increase of the animal requires another enlargement of its covering.

When a testaceous animal is going to enlarge its shell, as for instance the common snail, the body projects from the opening. It is then seen to attach itself to a wall or some other solid substance, and the portion of its body which is unprotected by the shell, is soon covered with the fluids which are excreted from its surface. The pellicle which they produce when the fluid dries, is at first an elastic, but gradually assumes more consistence, and becomes at last similar to the old part of the shell. If in this stage of the process a bit of the shell is broken and removed, without injuring the body of the snail, the skin of the animal is soon covered with a fluid, which gradually thickens, and becomes solid. Twenty-four hours after the operation, a fine crust may be observed, which constitutes the first and external layer, for repairing the breach which was made. At the end of some days this layer has become thicker, and in ten or twelve days, the new piece of shell which is formed, has acquired the same thickness as that which was removed. In making this experiment, certain precautions are necessary, otherwise there is some risk of its failure. If, after the broken piece of the shell has been removed,

and particularly if the fracture is made near the edge of the opening, the animal is not supplied with a sufficient quantity of nourishment, its volume or bulk is soon diminished; and now finding that what remains of the shell is a complete covering to its diminished body, no excretion takes place for the production of a new portion. In removing snails from a wall to which they had attached themselves, for the purpose of observing the progress of the formation of the shell, some days will elapse after they are placed in the box, before the process commences, because the testaceous matter which had been already expended after fixing on the wall, must be fully supplied before any new portion can be again formed.

This experiment shows clearly, that shells are only enlarged by receiving new additions of matter, after it has been excreted from the body of the animal, and not by *intus-susception*, or a circulation through the body of the shell itself. If this were the case, the production of new matter to fill up the breach made in the shell, would first appear all round the edge of the opening, and forming a kind of callus, similar to what happens in the reproduction of bony matter in other animals,it would gradually extend till the whole breach is filled up. But, on the contrary, this matter first appears on the body of the animal from which it has exuded, and the whole extent of the opening is closed at once by the fluid which has been directly secreted from the surface of the body. Nor can it be supposed that the liquid has insensibly exuded from the shell, and falling on the body of the animal, is there collected in sufficient quantity for the formation of the new piece of shell. This is fully demonstrated by the two following experiments of the same naturalist.

Reaumur broke several shells of snails, and, having made a very large hole about the middle of the shell, and about midway between its summit and opening, he introduced between the body of the animal and its shell, through the hole, a piece of skin which was extremely fine, but of a very close texture. He glued this skin to the internal surface of the shell, so that it shut up accurately the artificial opening which he had made. It must then be obvious, that if the reproduction of the piece of shell which was removed, depended on the excretion of a fluid from the shell itself, and not on that which proceeds from the surface of the animal's body, the new piece of shell would be formed on the external surface of the piece of skin which was introduced; and it is not possible that it could be formed between the skin and the body of the animal. But the contrary of this has always happened. The new testaceous matter is always deposited on the internal surface of the skin; that is,

on the side which is in contact with the animal's body; and no matter whatever was deposited on the other surface. This experiment has been repeated by others, and has been invariably attended with the same result.

The second experiment made by Reaumur is not less decisive than the first. He took a number of snails, and broke the shells, so that he diminished the number of the turns of the spire about one seventh part. Having in this way rendered the shell too small to cover the body entirely, they were nearly in the same situation as when an increase of the animal's body requires an augmentation of the shell. He then took a bit of skin, as in the former experiment, sufficiently large to cover the opening of the shell, and introduced one of its edges between the body of the animal and the shell, to the interior surface of which he glued it; after which having folded back the other extremity of the skin on the external surface of the shell, he glued it in like manner, so that the whole external opening was completely covered with the skin. The results were exactly the same as before. The shell grew, the skin remained in its place, and that part of it which was attached to the interior surface, was fixed between the new piece and the old shell, which consequently could not contribute to its formation.

From these experiments, which may be easily repeated, it appears that the increase of shells is owing to the secretion of an earthy and viscid animal matter which is prepared in the body of the animal, and which is successively formed by layers from the interior part of the shell to the external surface. This formation is determined by the previous enlargement of the animal. The different strata or layers of which shells are composed, can be easily demonstrated by exposing them to the action of fire, and removing them before their structure is entirely destroyed. By this process the animal matter is consumed, and the earthy substance remains, exhibiting a laminated structure. The same structure may be demonstrated, as has been already observed, in detailing Mr. Hatchett's experiments, by immersing a shell of the description of mother of pearl in a diluted acid. The earthy matter in this case is dissolved by the acid, and the layers of animal matter which are interposed, resisting the action of the acid, remain unchanged, and still retain the original figure of the shell.

It is a necessary consequence of the mode in which the shells of snails are increased, that they cannot enlarge in volume, but by the augmentation of the turns of the spire, and that the length of each turn of the shell already formed, remains always the same. This may be easily put to the test of experiment, by reducing the shell of a snail which has reached its full size, to the same num-

ber of turns with those of younger shells of the same species. The two shells do not then exhibit any other difference than in their thickness; and it would be the same, by comparing the youngest shells, those which have just separated from the egg, with the first turns of those of the same species which have been reduced by breaking them to an equal diameter. The number of turns or whorls of which the spire of a shell is composed, increases very considerably the size of the shell in univalves, and one turn more or less makes a great difference in their volume. According to Reaumur, the diameter of each turn of the spire is in the snail nearly double that of the preceding one, and one half of that which follows; but in many other shells, both marine and river, the last whorls of the spire, compared with the preceding ones greatly exceed this proportion. In some, the external opening is twelve times greater than the preceding one, and in others, it is not more than eight times. This depends entirely on the increase of the animal's body, and the proportion of that increase. The growth of some is lengthwise, and in them the increase of diameter is proportionably less; while others increase more in thickness than in length. Those testaceous animals which have only a few turns in the spire of the shell, are of this description. To the former, belong such as have a greater number of turns in the spire.

Those who have adopted the opinion of Klein with regard to the formation of shells, have denied the separation of the animal from the shell, which successively takes place near the tip in univalves. It is indeed on this circumstance of the connection of the animal with the shell, that the truth of this theory depends. According to it, the animal is attached to the internal surface of the tip of the shell in univalves, and on this connection depend the increase of the shell, and even the life of the animal. But it is a certain fact, that the posterior part of the body of the animal is entirely detached from the tip of the shell; and this holds, not only with regard to all land and sea shells which have lost the first turns of the spire, and consequently those of the tip; but also in a great number of other marine testaceous animals. It seems not only certain, but even necessary, that this separation between the animal and the shell should also take place in bivalve shells, if we take a distinct and rational view of their growth. Whether this separation is suddenly effected, or by a gradual process, which is most probable, it seems to be sufficiently obvious, by examining the internal surface of the valves. This is still more strongly confirmed by sawing univalve shells, particularly those which are considerably elongated, and have a great number of turns in the

spire, in a direction perpendicular to their axes. In old shells, several of the first turns of the spire will be found completely filled up with testaceous matter, so that the tip of the shell has become quite solid, or at least it will appear to have been long unoccupied by any part of the body of the animal. But in transparent shells, as in some species of helix, it is seen that this attachment does not exist; and the *H. planorbis* can be preserved alive, although the tip of the spire is broken off.

RED OR SLIPPERY ELM.

Ulmus rubra.

Fig. 1. A leaf. Fig. 2. The seed.

Except the maritime districts of the Carolinas and Georgia, this species of elm is found in all parts of the United States and of Canada. It bears the names of *Red Elm*, *Slippery Elm* and *Moose Elm*, of which the first two are the most common. The French of Canada and Upper Louisiana, call it *Orme gras*. This tree is less multiplied than the white elm, and the two species are rarely found together, as the red elm requires a substantial soil, free from moisture, and even delights in elevated and open situations, such as the steep banks of the Hudson, and the Susquehannah. In Ohio, Kentucky and Tennessee it is more multiplied than east of the mountains, and grows on the richest lands of an uneaven surface.

This tree is 50 or 60 feet high, and one or two feet in diameter. In the winter it is distinguished from the white elm, by its buds, which are larger and rounder, and which a fortnight before their developement, are covered with a russet down. The leaves are oval-acuminate, doubly denticulated and larger, thicker and

rougher than those of the white elm, and emit an agreeable odor. It blooms in the month of April. The flowers are aggregated at the extremity of the young shoots. The scales which surround the bunches of flowers, are downy like the buds. The flowers and seeds differ from those of the wahoo; the calyx is downy and sessile, and the stamens are short, and of a pale-rose color; the seeds are larger, destitute of fringe, round, and very similar to those of the European elms; they are ripe about the last of May.

The bark upon the trunk is brown; the heart is coarse-grained and less compact than that of the white elm, and of a dull-red tinge. The wood, even in branches of one or two inches in diameter, consists principally of alburnum or sap. This species is stronger, more durable, when exposed to the weather, and of a better quality than the white elm; hence in the Western States it is employed with greater advantage in the construction of houses, and sometimes of vessels on the banks of the Ohio. It is said to be the best wood in the United States for blocks, and its scarceness in the Atlantic States is the only cause of its limited consumption in the ports. It makes excellent rails, which are of long duration, and are formed with little labor, as the trunk divides itself easily and regularly: this is probably the reason that it is never employed for the naves of wheels. This tree bears a strong resemblance to a species or a variety in Europe, known by the name of *Dutch Elm;* the bark of which is very mucilaginous and also contains sugar, a little gallic acid and super-tartrate of potass. Medicinally it is said to be alternative, tonic and diuretic, and to be useful for herpetic and leprous eruptions. If it ever do good in such cases, it must be from its mucilage sheathing the acid or acrid substances of the *primæ vitæ*, from which they arise. The leaves and the bark of the branches, macerated in water, yield a thick and abundant mucilage, which is used for a refreshing drink in colds. The bark, when reduced to flour, is said to make excellent puddings. *Sylva Americana.*

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. V.

Mode of rearing Silk Worms in Europe. 'The various operations of an establishment for the production of silk are, ordinarily, all begun and concluded in the course of a few weeks; yet

they call for a considerable degree of attention on the part of its conductor, and can hardly be brought to a successful issue without the aid of experience. This is especially the case in Europe, where atmospheric changes are continually arising, which in various ways influence the tender silk-producing insect. One false step in management might be fatal, and one day's relaxation of the breeder's cares would suffice to bring all his previous labors to nothing.

'The degree of skilfulness and care thus required for the successful rearing of silkworms upon any useful scale, cannot be adequately estimated by the experience of those persons in England, who, as a matter of curiosity or of amusement, have watched over a few hundred worms, and have wound off the silk which these have furnished, unassailed by accident or misfortune. It is very natural to suppose, that what is so easily practicable with a small number, offers little difficulty as an extensive employment. If, however, the English breeder considers the time, however short it may have appeared, and the labor, however unimportant in his estimation, bestowed on his inconsiderable brood, and thence calculates the greater labor which must attend upon the rearing of hundreds of thousands, or, perhaps, millions of insects, its insignificance will disappear. He may then naturally imagine, how great is the importance of abridging that labor, of economizing expense, and of providing in every way against accidents, which, if occurring to interrupt his amusement, would be merely vexatious, but upon the avoiding of which, under other circumstances, depend the subsistence and well being of thousands.

'The proper choice of eggs is the first care of the cultivator. From this he may relieve himself in succeeding seasons, the operations of his own filature producing the requisite quantity. The Italian writers on the culture of silk give very copious directions for choosing eggs, and for detecting and avoiding the fraudulent arts sometimes practised by their venders.

'Good sound eggs are of a bluish-gray color; those which are yellow should on no account be purchased. It is common with the peasants whose eggs are of the latter description to give them so much the appearance of sound eggs, by washing them in muddy, dark-colored wine, that considerable judgment is required to detect the cheat.

'Where silkworms' eggs are brought from a distant country, much attention is demanded to prevent their premature hatching. This has been successfully accomplished by placing them, when newly laid, and carefully dried, in glass phials closely sealed to exclude air and moisture: the whole being then immersed in earthen

pots filled with cold water, which must be renewed as often as it becomes warm.

'The hatching process, until within a very few years of the present time, was usually conducted in a very immethodical or uncertain manner. Many cultivators depended on the spontaneous appearance of the worms, called forth only by the natural warmth of the advancing season.* Others had recourse to the heat of manure beds, but the method most frequently employed was to foster them into life by the heat of the human body. The mode of accomplishing this, was to place a small silk or cotton bag containing one or two ounces of eggs in the bosom next to the skin. The persons with whom these deposits were intrusted were forbidden to use any violent exercise, lest their charge might be crushed, or otherwise sustain injury through the consequent inequality of temperature. It would have been unsafe to continue the bags in this position during the night, and it was therefore most usual to place them beneath the pillow, which was previously heated to the temperature of the human body, using precautions also against injury, by placing some stiff substance over the eggs. When this companionship had lasted three days, and it was judged that the worms were shortly about to appear, the eggs were very gently transferred to shallow boxes made of thin wood, similar to those used for containing wafers: these were placed between warmed pillows as before described; and if the hatching were still further delayed, freshly-heated pillows were supplied through the ensuing day, and continued until the insects had burst their shells. Some persons used warmed pillows from the commencement, and avoided the system of human incubation.

'Count Dandolo recommended and adopted the use of stoves for heating the apartment in which his worms' eggs were hatched, and by such means rendered the operation in a great degree certain, removing, at the same time, much of the trouble by which it had previously been accompanied. Previously to placing the eggs in this heated atmosphere, the count caused the cloths to which the eggs adhered to be agitated for five or six minutes in a vessel containing water, in order to lessen the adhesiveness of the matter which retained them on the cloths. Having then suffered the water to drain from them during two or three minutes, the cloths were stretched out on tables, and the eggs were gently scraped from them by an instrument whose edge was not sufficiently sharp to cut the eggs, nor yet so blunt as to crush them. The eggs, thus removed, were placed in water and washed, still

* This is considered the most judicious way in the United States.

further to free them from gum, and to promote their separation from each other. If any floated on the surface in this washing, they were removed and destroyed as spoilt. The water again being drained from them, the eggs were next washed in some sound light wine, and gentle friction was used to perfect their mutual separation. They were then strained and dried, by being placed on an absorbing substance in a dry airy place, whose temperature was between forty-six and fifty-nine degrees of Fahrenheit's scale, there to await the proper moment for placing them in the stove room. It has always been customary in Italy to employ wine as a solvent for the gum which causes the eggs to adhere together, and which is thought to make the task of disengaging itself from the shell more difficult to the insect.

'It has been suggested, that one hatching room, upon a sufficient scale, might be employed for the general accommodation, in bringing forth all the silkworms of the surrounding district; and if proper confidence could be placed in the proprietor of such an establishment, there is no doubt of its great convenience to the cultivators.

'When eggs are first placed in the stove room, its temperature should be sixty-four degrees; on the third day this should be raised to sixty-six degrees; and on each following day the heat should be increased one or two degrees, so that on the tenth day it shall have reached eighty-two degrees, which point must not be exceeded. The degree of warmth required for hatching the eggs of silkworms depends very much, however, upon the temperature to which they have been exposed during the preceding winter. It is, therefore, important that this point should be considered, so as to avoid premature hatching on the one hand, and too great a retardation on the other, which would follow if the eggs had been exposed to any severity of cold.

'When the eggs assume a whitish color, it is a sign that they are about to be hatched; and now, by the aid of a magnifying glass, the worms may be seen formed within the shells. Sheets of white paper, abundantly pierced with holes, or otherwise pieces of clear muslin, should now be placed over the eggs, covering them entirely; when, as the worms come forth, they will climb through to the upper surface of the paper or muslin.

'To collect the worms for the purpose of conveying them to the rearing house, small twigs of mulberry, with very few leaves, are placed on the paper. On these leaves the newly-hatched worms immediately fix, and fresh twigs being constantly supplied to meet the wants of the continually-increasing number of worms, the whole may be readily collected. When their removal to any considerable

distance is necessary, this is easily and safely performed by placing the sheets of paper and mulberry twigs in boxes or well-lined baskets, using every precaution to exclude the external air from the now-delicate brood. The worms should be removed only in fine weather, and during the warmest part of the day, and they should be supplied with leaves for their consumption while on the road.

'The apartment wherein the newly-hatched worm sare placed must be dry and warm, with its windows opening on opposite sides, that perfect ventilation may be obtained when desirable. The room should be furnished with a stove, and thermometers must be provided, that the temperature may be precisely regulated. Wicker shelves are usually placed around at convenient distances, and are lined with paper; on these the worms are placed. The greatest precautions must be taken to prevent the intrusion of rats and mice, as well as many of the insect tribe, as these are more or less destructive to silkworms. Smoke, and bad smells, are likewise considered prejudicial, and must be avoided.

'All writers on the treatment of these insects agree in recommending, that worms which are not hatched at the same time should on no account be placed together. The neglect of this precaution would occasion constant trouble to the attendants; the changes occurring at different periods, it would be impossible to attend to the quantity of their food with the degree of regularity that is desirable. This point is so much insisted upon by many cultivators, that to avoid the evil, all eggs which remain unhatched beyond the second day after the first appearance of the worms are destroyed. It is said also, that if those of a later birth are reared, they generally prove weak in constitution, and produce less than their proper quantity of silk.

'It has been computed, that three square feet of surface afford ample space for the worms proceeding from an ounce of eggs, until the period of their first sickness is passed; and that this space should be multiplied thrice at each succeeding age. Count Dandolo considered that silkworms would be injuriously crowded in these dimensions, and recommended, that eight square feet should be allotted to the worms during their first age; fifteen feet for the second age; thirty-five feet for the third; eighty-two and a half feet for the fourth; and about two hundred feet for the fifth age.

'The mulberry leaves given to the newly-hatched brood should be young and tender, and chopped into minute portions. These should be strewed evenly over the whole space of the shelves, that there may not be any unnecessary crowding of the insects in one spot. It is indeed advisable, when—as they sometimes will

—the worms get heaped upon one another, that a leaf should be presented over them; to this some will quickly attach themselves, and may then be removed to a less crowded situation.

'The worms proceeding from one ounce of eggs will consume six pounds of chopped leaves before their first moulting. Their second age is of shorter duration, but the greater size of the worms requires a more abundant supply of food; and eighteen pounds of leaves, chopped less finely than before, must be given, during its continuance, to the same number. In the third age, sixty pounds of leaves, still a little chopped, must be given; one hundred and eighty pounds will be consumed during their fourth age; and in their fifth and longest age, one thousand and ninety-eight pounds of leaves are devoured by these insects, which, when hatched a few weeks before, weighed less than an ounce.

'These quantities are stated on the supposition that the worms are uniformly healthy. If many of them should die in the intermediate time, the weights mentioned will be in excess. On the other hand, if the season should be wet, the leaves will not contain the usual nourishment, with reference to their weight, and more must be given; whereas, if the season should prove more dry than ordinary, the nutriment in the leaves will be greater, and the quantity given may be diminished with advantage. The skill of the cultivator is shown by the weight of silk obtained in proportion to the leaves consumed; and his judgment is tasked to apportion these according to their nutritive properties. There will be no real economy in keeping the consumption of food too low; this, however, is not a common fault, and evils occur much more frequently from over feeding and waste of leaves.

'The worms should be fed with regularity four times a day; and intermediate repasts may be occasionally given, where their appetites appear to be increased in voraciousness. The advantage of chopping the leaves for young worms consists in the economy it introduces. Many thousand insects may, by this means, feed simultaneously upon a few ounces of leaves, whose freshly-cut edges seem better adapted to their powers when newly hatched. If the leaves were given to them whole, a much greater number must be supplied than would be consumed while their freshness lasted, and great waste would be the consequence. The worms will always quit stale leaves for those which are newly gathered. Availing themselves of this fact, some persons provide wire-bottomed frames, which they cover with fresh leaves, and lower them within reach of the worms. These instantly make their way through the reticulations of the wire, and fixing upon the leaves above, the frame may be raised and the litter removed with-

out touching the worms, which might be injured by even the gentlest handling.

'When the silkworms give indications that they are about to spin, little bushes must be provided for the purpose. These may be of broom, heath, clean bean stalks, or, in short, any bush or brushwood that is tender and flexible. These should be arranged upright in rows between the shelves, with intervals of fifteen inches between the rows. The bushes should be so high as to be bent by the shelf immediately above into the form of an arch. They should be so spread out, that a supply of air should freely reach every part, and ample space should be afforded for the worms to fix themselves and spin; otherwise, there is great hazard of their forming double cocoons, in which two worms assist in the preparation of one dwelling for both; the silk in these is so much less adapted to the purposes of the reeler, that a double cocoon is worth only one half the price of a single one. Inattention to this point is very common, and occasions constant losses. When the twigs already erected appear to be adequately furnished with worms, other similar hedges should be formed, parallel to the first. The spaces between the shelves will thus present the appearance of small avenues or arbors covered in at the top.

'The worms at this time require much careful watching, and occasional assistance must be afforded to those which are sluggish, that they may find an elligible spot for forming their cocoons. Those worms which appear still inclined to feed must be supplied with leaves; so long as the slightest inclination for food remains they will not attempt to form their cocoons. It will sometimes happen, that even after they have climbed among the branches for the purpose of spinning, they will again descend to satisfy their last desire for food. "I have seen them," says a minute observer, "stop when descending, and remain with the head downwards, the wish to eat having ceased before they reached the bottom." In such a case, they should be turned with their heads upwards, as the contrary position is injurious to them. If, at this time, many appear weak and inert, remaining motionless on the leaves, neither eating nor giving any sign of rising to spin, some means must be taken to stimulate them to the exertion. It was the ancient practice, and found to be efficacious for this purpose, to convey some pungent article, such as fried onions, into the apartment, the effluvia from which revived the worms, inciting some to take their last meal, and inducing others, whose desire for food had ceased, to climb the twigs and begin their labors. The same end is now generally and unfailingly attained, by removing the sluggish worms into another apartment, the temperature of which is higher.

All these minute directions may perhaps appear frivolous; but it is only by an unceasing attention to these and the like minutiæ, that any tolerable success can be secured. When all the previous cares and labors of an establishment have been satisfactorily accomplished, if the hedges be not well formed, are irregular; or too thick in any parts, so as either to impede the circulation cf air, or too far to limit the space in proportion to the number of worms, ill success will be sure to follow. Instead of the proper number of fine single cocoons, many will be double, others imperfect or soiled, and even some of the silkworms will be suffocated before the completion of their labors.

'It is essential, in every age of the worms, to attend to the regulation of temperature in their apartments; and at no time is this more necessary than while they are forming their cocoons. If, at this time, they are exposed to much cold, they desist from their labors. Should the balls be sufficiently thin, the insects may be discerned, either quite inactive, or moving very slowly. On the temperature being raised, they will immediately resume their work with renewed activity, and will once more desist, if the cold be again allowed to exert its influence. After they have remained inactive from this cause for a short time, they put off their caterpillar form, and assume that of the chrysalis, without having sufficient energy to complete their silken covering.

'The fifth volume of the transactions of the Society for the Encouragement of Arts, &c. contains a letter upon this subject from a gentleman, who relates, that in the summer of 1786 he had successfully reared to their full growth more than thirty thousand silkworms, when at the beginning of July, and just as they appeared about to spin, a chilling north-east wind set in, and many of the worms became chrysalides, without attempting to spin. On the examination of these, it appeared that the glutinous matter in their silk reservoirs had become so congealed by the cold, as to resemble strong tendons, both in appearance and tenacity; which sufficiently accounted for the inability of the insects to draw forth the silk in filaments. Thousands of the worms changed in this profitless manner daily, until at length, the survivors being removed into an apartment artificially warmed, they immediately applied themselves to the performance of their usual functions. It is desirable that while silkworms are in the act of spinning, the temperature of their apartment should be maintained as high as 70 degrees, and it is at the same time equally important that free ventilation should be secured.

'The opinion has been very generally entertained that violent noise disturbs, and injuriously affects the worms, and that any

sudden report, as of fire arms or thunder, will cause them to fall from their arbors. The peasants in Italy who attend on silkworms are so strongly of this opinion, that if the caterpillars omit to rise and spin after thunder has been heard, they consider its noise as the sole reason of the failure; they are always desirous of removing every cause for noise from about the establishment. This opinion appears, however, to be badly founded, and has been satisfactorily refuted by persons who have made experiments to ascertain the fact. Silkworms have been reared in all the bustle of a town, exposed to the barking of dogs, and to concerts of music, without in any way exhibiting signs of being affected by the noise. The following statement is conclusive. It is taken from the "Cours d'Agriculture," written by Monsieur Rozier, and recounts an experiment performed in the establishment of Monsieur Thome, a considerable silk cultivator, and one of the earliest writers on the subject. These gentlemen, Messrs. Rozier and Thome, in the presence of many witnesses, fired several pistol shots in the apartment where silkworms were either spinning, or rising preparatory to their labor; and the only worm that dropped was evidently a sickly insect, that could not have formed its cocoon under any circumstances!

'It is seldom that any opinion upon a point of practice is entertained, without some ground for its existence. The Italian peasants, although certainly wrong in attributing any evil effects to the agency of noise, might have been correct had they ascribed the evil to that great accumulation of electricity in the atmosphere which attends the discharge of the fluid, from one cloud which is overcharged upon another which is deficient; or which accompanies the fluid in its passage between the clouds and the earth, until an equilibrium establishes itself in the mass. "Before this equilibrium is gained, however," says Monsieur Rozier, "we know that many persons exhibit symptoms of strong excitement, falling into convulsions, or even being affected by fever. Is it, then, surprising, that insects charged with a matter so highly electric as silk should become oppressed or overpowered by the superaddition of that which they receive from the atmosphere?" The peasants in the silk provinces of France have long been accustomed to place pieces of iron in the neighborhood of the insects. If asked to assign their motive for this, their reply is, that their fathers and grandfathers did so before them, and that therefore the practice must be desirable. May we not imagine that this custom had its rise from the remarks of some philosophic observer of the laws of nature, and who, under other and more fa-

vorable circumstances, might have been led, by generalizing, to anticipate the discoveries of Franklin?

'Monsieur Rozier, in the work already quoted, recommended the use of metallic conductors; and himself proved their efficacy. In connection with some shelves containtng silkworms, he placed thin iron wires, and carried them through the wall into a cistern of water. The remaining shelves were, in every other respect, similarly circumstanced to these; but he uniformly found that, when thus protected, the worms were decidedly more healthy and active than those unprovided with conductors.'

ORNITHOLOGY.

NO. V.

Nests of Birds. Most birds, at certain seasons, live together in pairs, and the union generally continues while the united efforts of both are necessary in forming temporary habitations, and in rearing their offspring. Eagles and other birds of prey continue their attachment for a much longer time, and sometimes for life. The nests of birds are constructed with so much art as to baffle the utmost exertion of human ingenuity to imitate them. The mode of building, the materials they make use of, as well as the situation they select, are as various as the different kinds of birds, and are all admirably adapted to their several wants and necessities. Birds of the same species collect the same materials, arrange them in the same manner, and make choice of similar situations, for fixing the places of their temporary abodes. Wherever they dispose themselves, they always take care to be accommodated with a shelter, and if a natural one does not offer itself, they very ingeniously make a covering of a double row of leaves, down the slope of which the rain trickles, without entering into the little opening of the nest that lies concealed below. In forming the nest, they make use of dry wood, bark, thorns, reeds, thick hay and compact moss, as a foundation, and on this, as a first layer, they spread and fold in a round form, all the most delicate materials, as down, wool, silk, spiders' webs, feathers and other light substances, adapted for the purposes for which they are intended, and to the climate in which the nest is situated. Thus, the ostrich in Senegal, where the heat is excessive, neglects her eggs during

the day, but sits on them during the night. At the cape of Good Hope, where the heat is less, the ostrich like other birds, sits upon her eggs both day and night. In countries infested with monkies, many birds, which in other climates build in bushes and clefts of trees, suspend their nests upon slender twigs, and thus elude the utmost art of their enemies. In all cases we may observe, without entering into particulars, that the architecture of the nest's of each species, seems to be adapted to the number of eggs, the temperature of the climate, or the respective dimensions of the little animal's body. Small birds, whose eggs are generally numerous, make their nests warm, that the animal heat may be equally diffused, but the larger species are less solicitous in this respect. The smaller tribes also, that live upon fruit and corn, and are often regarded as unwelcome intruders upon the labors of man, use every caution to conceal their nests from the eye, while the only solicitude of the great bird is to render their refuge inaccessible to wild beasts and vermin.

ON THE DEW.

There is not a phenomenon of nature more common, nor more beautiful than that of dew. The poets of course have seized it with avidity, to decorate their favorite themes, and particularly their descriptions and personifications of the morning. Milton introduces it into his descriptions with a peculiar felicity:

> 'Now morn her rosy steps in th' eastern clime
> Advancing, sow'd the earth with orient pearl.'

The same divine bard, in speaking of the prodigious host of satan, has introduced dew into a most beautiful simile:

> 'An host
> Innumerable as the stars of night,
> Or stars of morning, dew drops, which the sun
> Impearls on every leaf and every flower.'

In Samson Agonistes, when Delilah comes to visit her eyeless husband, she is afraid to approach; and Milton has made her silence most beautifully expressive: the chorus tells Samson:

> 'Yet on she moves, now stands, and eyes thee fix'd,
> About t' have spoke, but now, with head declined,
> Like a fair flower surcharged with dew, she weeps,
> And words address'd seem into tears dissolved,
> Wetting the borders of her silken veil.'

Thus Pope in his elegy to the memory of an unfortunate lady:

> 'Yet shall thy grave with rising flowers be drest,
> And the green turf lie lightly on thy breast;
> There shall the Morn her earliest tears bestow,
> There the first roses of the year shall blow.'

'The falling of the dew is a phrase received in all languages, among all people, learned and ignorant; and all express by it their opinion that those drops of water which we find in mornings and evenings on the grass and herbage of the fields have descended from the upper regions of the air. On the contrary, we assert, not as an opinion, but a certainty, that these drops of dew never, in this state, were higher above the earth than we see them, and that they do not descend from on high at all, but rise out of the earth, and never, as dew, fall to it again.* There is, indeed, no law in nature by which dew could be formed as it has been generally understood to be; but all the established doctrines of philosophy and mechanics concur in the production and formation of it upon this plan. The earth is, to some considerable distance, always more or less moist; the action of the sun heats the earth's surface, and heat must raise that moisture up in vapor; the heat occasioned by the sun will continue, though in a more remiss degree, during the whole night; and while it continues, vapors will also continue to be raised. It is evident, therefore, that vapors are rising all day and all night from the earth. What rise in the day time are dispersed and evaporated by the heat of the air as soon as raised, and we see nothing of them; but what rise in the absence of the sun, and in a cooler state of the air, form themselves into drops, according to the known laws of attraction. Such, then, is the nature and origin of dew; it is water raised in form of vapor from the earth, in consequence of its being heated by the sun; it collects itself into drops on any thing proper to receive and retain it; or it hangs on the lower regions of the air, in form of a fog or mist, till the sun's rays evaporate and dissipate it. Such are my assertions in regard to dew. The facts which led to, and will be found to support them, are these. The late Lord Petre had engaged me to spend a part of the last summer of his life at his house in Essex. He was as fond as myself of experiments that tended to some obvious purpose, and accompanied my observations during that period. One of these was an experiment in regard to the quantity of dew suspended in the air

* Though the condensation of vapor into dew may take place all the way to the surface of the earth, and be greatest nearest to the surface, yet the dew does fall after it has been formed into sensible particles.

at the different periods of the night. The manner of proceeding was by hanging up several bundles of tow, at different heights in the air, and weighing them from time to time, as they became more and more wetted by it. We evidently found from this, that the dew impregnated the air in greater quantities in the beginning of the night than at any other time; the increase of moisture growing less and less towards the morning. Additionally to this, however, I discovered that those bundles of tow which had hung lowest, or nearest the earth, were wet sooner than those which were placed higher. From this circumstance I alleged that the dew did not descend from the air, but ascend from the earth. The thought at first startled his lordship; but we determined to give it a fair trial. We suspended a large square of glass flatwise, by a string, from a horizontal pole laid over the tops of two distant trees in the garden, and we found its lower surface became wet sooner than its upper. From these experiments, nothing can be more evident than that the "falling of the dew" is an improper phrase, and the generally-received opinion which gave rise to it is a false one.*'

The Holy Scriptures abound with admirable allusions to dew, and it is always represented as a great blessing. 'Blessed of the Lord,' says Moses, speaking of Joseph, 'be his land, for the precious things of heaven; *for the dew*,' &c. And the want of it is represented as a curse; 'Ye mountains of Gilboa,' said David, '*let there be no dew!*' The favor of the Divine Being is compared to the dew; 'I will be,' says the Lord, by Hosea, '*as the dew* unto Israel; he shall grow as the lily, and cast forth his roots as Lebanon.' Heavenly doctrine, or the word of God, is likewise compared to dew. 'My doctrine,' says Moses, 'shall drop as the rain, *my speech shall distil as the dew*, as the small rain upon the tender herb, and as the showers on the grass;' that is, my doctrine shall have the same effect upon your hearts, as dew has upon the earth; it shall render them soft, pliable, and fruitful.' But the admirable allusions to dew in holy writ are too numerous to be quoted. In a word, these transparent beauties of the morning not only furnish us with poetic images and philosophic knowledge, but with very powerful motives for a life of piety, benevolence and virtue. Their great utility to the vegetable kingdom, in particular, should lead us to the unceasing adoration of that gracious Being, who created nothing which has existence merely for an object of idle speculation.

* Dr. John Hill.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR MARCH, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	22	30	23	30.43	30.49	30.50	Fair	Fair	Fair	N. W.	N. W.	N. W.	
2	52	53	55	30.50	30.49	30 30	Fair	Fair	Fair	N. W.	S. E.	S. W.	
3	36	46	34	30.00	29 95	30.12	Cloudy	Fair	Fair	S. W.	N. W.	N. W.	
4	27	38	33	30.20	30.20	30.20	Fair	Fair	Fair	N. W.	E.	E.	
5	33	38	39	30.08	30.00	29.98	Snow	Rain	Rain	E.	E.	E.	
6	37	37	34	29.61	29.57	29 60	Cloudy	Rain	Fair	N. E.	N. W.	N. W.	1.64
7	29	33	34	29.68	29.80	30.02	Fair	Fair	Fair	N. W.	N. W.	N. W.	
8	22	36	38	30.19	30.15	30.10	Fair	Cloudy	Fair	N. W.	N. W.	N. W.	
9	37	59	44	30.15	30.15	30.10	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
10	46	59	42	30.12	30 20	30.40	Fair	Fair	Fair	S. W.	S. W.	N. W.	
11	38	43	39	30.40	30.39	30.28	Fair	Cloudy	Rain	E.	N. E.	N. E.	
12	50	62	48	30.00	29.90	29.60	Rain	Cloudy	Fair	S. W.	S. W.	S. W.	*
13	43	53	39	29.52	29.62	29.70	Fair	Fair	Fair	N. W.	N. W.	N. W.	
14	19	22	17	29.75	29.80	30.10	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	
15	15	32	27	30.33	30.40	30.45	Fair	Fair	Fair	N. W.	S. W.	S. W.	
16	28	43	32	30.41	30.40	30.38	Fair	Fair	Fair	S. W.	S. W.	S. W.	
17	36	38	36	30.12	29.70	29.58	Cloudy	Rain	Rain	N. E.	N. E.	N. E.	
18	20	17	19	29.51	29.62	29.94	Snow	Fair	Cloudy	N. W.	N. W.	N. W.	
19	15	22	22	30 10	30.20	30.25	Fair	Fair	Fair	N. W.	N. W.	N. W.	
20	18	36	34	30.28	30.22	29.95	Fair	Fair	Fair	N. W.	S. W.	S. W.	
21	39	43	32	29.66	29 54	29.62	Rain	Cloudy	Fair	S. W.	S. W.	N. W.	
22	24	32	24	29.77	29.85	30 02	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	22	40	34	30.10	30.19	30.15	Fair	Fair	Fair	N. W.	N. W.	S. W.	
24	38	60	48	30.05	30.05	30.02	Fair	Fair	Fair	S. W.	S. W.	S. W.	
25	43	68	58	30.02	30.02	30.00	Fair	Fair	Fair	S. W.	S. W.	S. W.	
26	52	59	32	29.94	29.90	30.00	Cloudy	Cloudy	Rain	S. W.	S. W.	N. W.	
27	26	36	30	30.02	30.35	30.37	Fair	Fair	Fair	N. W.	N. W.	N. W.	
28	26	36	32	30.37	30.37	30.30	Fair	Fair	Fair	N. W.	E.	S. W.	
29	31	35	27	30.30	30.30	30.39	Fair	Fair	Fair	N. E.	N. E.	N. E.	
30	25	40	32	30.39	30.42	30.30	Fair	Fair	Fair	N. W.	E.	S. W.	
31	34	59	44	30.16	29.95	29.72	Fair	Fair	Fair	S. W.	S. W.	S. W.	

Depth of rain fallen 1.64 inches.

*The quantity of rain fallen in the remainder of the month, was too small to be measured.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

Pendleton's Lithog.y Boston

THE BRUNSWICK FIG.

THE NATURALIST.

JUNE, 1832.

THE FIG TREE.

The fig tree is evidently a native of that part of Asia, where the garden of Eden is generally said to have been situated, as it is the only tree particularly named in those passages of the Bible, which relate to the creation and fall of man. '*And they sewed fig leaves together and made themselves aprons.*' It is a fruit that appears to have been highly esteemed by the Israelites, who brought figs out of the land of Canaan, when they were sent by Moses to ascertain the produce of that country.

The fig tree is often mentioned both in the Old and the New Testament, in a manner to induce us to conclude that it formed a principal part of the food of the Syrian nation. In the twenty-fifth chapter of the first book of Samuel, we read, that when Abagail went to meet David, to appease him for the affront given by Nabal her husband, she took with her, among other provisions, a present of two hundred cakes of figs.

When Lycurgus banished luxury from Sparta, and obliged the Spartan men to dine in one common hall, to enforce the practice of temperance and sobriety, every one was obliged to send thither his provisions monthly, which consisted of about one bushel of flour, eight measures of wine, five pounds of cheese and two pounds and a half of figs.

The Athenians were so choice of their figs, that it was forbidden to export them out of Attica. Those who gave information of this fruit being sold contrary to law, were called *sykophantai*, from two Greek words signifying the discoverers of figs; and as they sometimes gave malicious information, the term was afterwards applied to all informers, parasites, liars, flatterers, imposters &c., from whence the word *sycophant* is derived.

The story of Romulus and Remus being suckled by a wolf under a fig tree, proves that this fruit must have been early known in Italy.

The Egyptians and Greeks held this fruit in great estimation; it was their custom to carry a basket of figs next to the vessel of wine used in the *Dionysia*, or festivals in honor of Bacchus; and it is related to have been the favorite fruit of Cleopatra, who was the most luxurious queen the world ever produced. The asp with which she terminated her life, was conveyed to her in a basket of figs.

Saturn, one of the Roman deities, was represented crowned with new figs; he being supposed to have first taught the use of agriculture in Italy. There was a temple in Rome dedicated to this god, before which, grew a large fig tree. The vestals, when they removed this tree in order to build a chapel on the spot, offered a propitiatory sacrifice; this happened about 268 years after the foundation of the city.

The fig was a fruit much admired by the Romans, who brought it from most of the countries they conquered, and had so increased the varieties in Italy, by the commencement of the christian era, that Pliny has furnished us with a description of twenty-nine sorts that were familiar to him. He says, 'figs are restorative, and the best food that can be taken by those who are brought low by long sickness and are on the recovery.' He adds, 'that figs increase the strength of young people, preserve the elderly in better health and make them look younger and with fewer wrinkles. They are so nutritive as to cause corpulency and strength ; for this cause,' continues he, 'professed wrestlers and champions were in times past fed with figs.' This naturalist mentions the African figs as being admired; but says, 'it is not long since they began to grow figs in Africa.' These appear to have been of an early kind; for we find when Cato wished to stimulate the senators to declare war against Carthage, he took an early African fig in his hand, and then addressing the assembly, he said, 'I would demand of you how long it is since this fig was gathered from the tree?' and when they all agreed that it was freshly gathered, 'yes,' answered Cato, 'it is not yet three days since this fig was gathered at Carthage; and by it, see how near to the walls of our city we have a mortal enemy.' With this argument he prevailed upon them to begin the third Punic war, in which Carthage, that had so long been a rival to Rome, was utterly destroyed. 'The Lydian figs,' says Pliny, 'are of a reddish-purple color; the Rhodian, of a blackish hue; as is the Tiburtine, which ripens before others. The white figs were from Herculaneum, Albicerate and

Aratian; the Chelidonian figs are the latest, and ripen against the winter; some bear twice a year, and some of the Chalcidian kind bear three times a year.' The Romans had figs from Chalcis and Chios, and many of their varieties, it appears, were named from those who first introduced or cultivated them in Italy. The Livian fig was so named after Livia, wife to the emperor, Augustus, who, it is said, made an unnatural use of it to poison her husband.

The fig tree is a low shrub naturalized in Italy and the south of France, and enduring the open air in the mildest parts of Britain and the United States. This tree, in France and Italy, grows as large as our apple trees, but in England and this country seldom exceeds two yards in height; the trunk is about the thickness of a human arm; the wood is porous and spongy; the bark ash-colored; the branches smooth with oblong white dots; the leaves annual in the temperate zones, but perennial within the tropics, cordate, ovate, three or five lobed, thick, and the size of the hand. The fruit is a berry, turbinate, and hollow within; produced chiefly on the upper part of the shoots of the former year, in the axils of the leaves, on small, round peduncles. The flowers are produced within the fruit; what is considered as the fruit being a common calyx or receptacle; the male flowers are few, and inserted near the opening in the extremity of the receptacle, or fruit; the female flowers are very numerous, and fill the rest of the hollow space within. The greater part prove abortive, both with and without the process of *caprification*. The fig tree is distinguished from all other trees, with which we are acquainted, by its bearing two successive and distinct crops of fruit in the same year, each crop being produced on a distinct set of shoots; but this climate rarely allows the second crop to come to maturity, except where they are forced by hot-house culture.

The *caprification* of figs was practised by the ancients in the same manner as it is now attended to by the inhabitants of the Archipelago; and it is described by Theophrastus, Plutarch, Pliny and other authors of antiquity. It is too curious a circumstance in the history of the fig tree to be omitted, as it furnishes a convincing proof of the reality of the sexes of plants. In the cultivated fig, the receptacles are found to contain only female flowers, that are fecundated by means of a kind of gnat (*culex L.*) bred in the fruit of the wild fig trees, which pierces that of the cultivated, in order to deposit its eggs within, at the same time diffusing within the receptacle the farina of the male flowers; within this operation, the fruit may ripen, but no effective seeds are produced. Hence it is, that we can raise no fig trees from the fruit of our gardens, having no wild figs to assist the seed.

They are consequently raised by cuttings, layers, suckers, roots, and by ingrafting; the most general method is by layers or cuttings which come into bearing the second, and even the first year.

In many parts of the Grecian Islands, the inhabitants pay such attention to the caprification of the cultivated figs, that they attend daily for three months in the year to gather these little flies from the wild fig trees in their gardens, by which means they not only get finer fruit, but from ten to twelve times the quantity; thus one of the most minute insects is, by the attention of man, made a principal cultivator of fruit.

It is a curious fact, that freshly-killed venison, or any other animal food, being hung up in a fig tree for a single night, will become as tender, and as ready for dressing, as if kept for many days or weeks in the common manner. We are told of a gentleman, who made the experiment of suspending a haunch of venison which had lately been killed, in a fig tree when it was in full foliage, at about 10 o'clock in the evening, and was removed in the morning before sunrise, when it was found in a perfect state for cooking; and he adds, that in a few hours more, it would have been in a state of putrefaction.

We import the best dried figs from Turkey, Italy, Spain and Provence. In the south of France, they are prepared by dipping them in scalding-hot lie, made of the ashes of the fig tree, and then dried in the sun.

The most suitable kind to raise in Great Britain or the northern part of the United States, is the Brunswick fig, (*Ficus indica.*) Plate 6. In a south-east corner, trained against a wall, it ripens in England by the middle of August, and about a month later in New England. It is necessary however, in this country, to secure it from the frosts during the winter, and to remove it as early in the spring as the season will admit. The leaves are very deeply five lobed, the lobes narrow, and of nearly equal width. The fruit is very large, obovate, fleshy, with an unusually oblique apex. The eye is rather depressed. The stalk short and thick. The skin pale green on the shaded side with a tinge of yellow; next the sun, dull, brownish red, sprinkled with small pale brown specks. The flesh is pinkish in the interior, nearly white towards the skin, but chiefly semi-transparent reddish brown, extremely rich, sweet and highly flavored.

The fig is cultivated in Great Britain and in this country entirely for the dessert, but in fig countries, it is eaten green or dried, fried or stewed, and in various ways, with, or without bread or meat, as food. Abroad the fig is introduced during dinner, as well as at the dessert. In common with the melon, it is present-

ed after soup; and the person who cuts a fig, holds it by the small end, takes a thin circular slice off the large end, and then peels down the thick skin of the fruit in flakes, making a single *bonne bouche* of the soft interior part.

For medical purposes, figs are chiefly used in emollient cataplasms, and pectorial decoctions.

The wood of the fig tree is of a spongy texture, and, when charged with oil and emery, is much used in France by locksmiths, gun smiths and other artificers in iron and steel, to polish their work. This wood is considered almost indestructible, and on that account was formerly used in Egypt and other Eastern Countries, for embalming bodies. The milky sap of this tree may be used as rennet, and for destroying warts.

We shall conclude our account of the fig tree by the well-known story of Timon of Athens, who was called *Misanthrope*, for his aversion to mankind and to all society. He once went into the public place, where his appearance as an orator, soon collected a large assembly, when he addressed his countrymen by informing them that he had a fig tree in his garden, on which many of the citizens had ended their lives with a halter; and that, as he was going to cut it down, he advised all those that were inclined to leave the world to hasten to his garden and hang themselves.

CONCHOLOGY.

NO. IV.

Of the Colors of Shells. The infinite variety of the colors of shells is one of the most striking parts of their history; and it becomes a curious and interesting object of investigation to inquire whether these colors are uniform and constant in the spires, and from what proceeds this regularity and uniformity. The experiments and observations of Reaumur will assist us in this investigation. When a hole is made in a shell, nearly at an equal distance between its tip and opening, the new piece of shell which is formed to shut up the hole, is usually of a white, and often very different from that of the rest of the shell. It would appear at first that the new piece is of a different nature, and that it is not formed in the same way as the rest of the shell. To meet this difficulty, it will be necessary to explain on what depends the regular variety of the colors of certain shells; the same

experiments will lead to the discovery of the cause of the one, and will serve to unfold the other.

This remarkable variety of color is in no shell more remarkable than in the *Helix nemoralis.* The ground of this shell is white, citron, or yellow, or a compound of different shades of these colors. Different colored rays are traced on this ground, turning spirally with the shell; in some they are black, in others brown, and sometimes reddish. The breadth of each of these rays gradually increases as they approach to the opening of the shell. It even sometimes happens, that two of these bands are so much extended in breadth, that they meet together and form one. Some individuals have five or six of these bands, while others have three or four, and even two, and sometimes only one. Others again have none at all, although of the same species; and among the individuals which are marked with colored bands, they are not always of the same breadth in the same parts of the shell; from which it appears, that no certain specific characters can be derived from the color, since it is subject to so much variety. According to Reaumur, the viscid and earthy matter of which the shell is composed, is secreted from the surface of the animal's body; but in certain places of the surface, particles which produce a different color are separated; and whether this depends on a peculiar organization of those places, or on the form of the particles themselves, it appears that these particles, either of a different nature, or of a different figure, by uniting, form bodies which reflect different rays of light; that is to say, form parts of the shell of different colors.

This seems to be a necessary consequence of the mode in which the growth of shells is accomplished. The whole external layer of the shell is formed by the neck of the animal, because it is that part which is nearest to the head, and consequently as the animal increases in size, that part ceases to be covered with the old shell. It therefore depends on this part of the animal to extend the shell, and for this purpose it is sufficient that the neck be furnished with glands for secreting the different fluids, to form a shell of different colors. If, for instance, there are two or three glandular bodies which secrete brown or blackish particles, and that these glandular bodies are disposed in a parallel direction to each other, while the glands on the rest of the surface only secrete particles of matter which reflect the light of a citron color, the shell formed by these bodies will have a citron ground, with black or brown bands, nearly parallel, or which gradually approach to each other, and become larger in the same proportion as the external organs of the animal increase in size.

If no such glandular structure, or difference in the matter secreted, should be traced on the neck of the *Helix nemoralis* this explanation of the cause of the variety of colors in shells would appear extremely probable; but this probability amounts to certainty, from the actual observation of the existence of this peculiarity of structure and effect. When the *Helix nemoralis* is deprived of part of its shell, the body appears of a white color, excepting towards the neck, where the white inclines to yellow, and where besides there is a number of black or brown bands, equal to that of the bands of the shell, and arranged in the same direction. It has been observed, too, that the individuals which have only one black stripe on the shell, have only one single black spot on the neck; and those having four spots on the neck, have four stripes of the same color on the shell. These rays are placed immediately under those of the shell; they commence at the distance of about a line from the extremity of the neck, which is itself usually spotted with black all round. The existence, therefore, of these excretory organs can no longer be doubted. The difference of color seems to prove the difference of structure. But to establish this beyond the possibility of doubt, it is only necessary to have recourse to experiment, by observing what happens in the new piece of shell which is renewed, in place of that portion which has been removed, and if it appear that the part of the shell which is formed opposite to the black rays of the animal, is black, and if that which is formed between the stripes, be of a different color from that of the stripes themselves on the rest of the body, no farther proof can be required. Now, it has been observed, that the part of the new shell formed on the neck opposite to the black or brown stripes on the animal's body, is itself black or brown; that formed between the stripes is white or citron, while the rest of the body is white, but different from that of the neck, when it is of this color.

It sometimes happens, that the part of the shell which has been renewed is of a different color. This apparent deviation will appear less difficult to be reconciled to the explanation of the process which has now been given, if we attend to the circumstance that the new shell formed opposite to the neck of the animal is never different from that of the old shell, excepting that the external surface is extremely rough, and presents numerous furrows or groovs, in place of the smoothness and fine polish of the old shell. In this case, the inequality of surface is occasioned by the motion of the animal retiring within its shell, before the new piece has acquired sufficient consistency and solidity; and thus the new shell, having contracted on its surface wrinkles or furrows, the

light is very differently reflected. But there is another cause for this difference of color in these circumstances. When a large piece of shell is removed, the first layer which is formed is usually white. The particles of the fluid which are necessary for the formation of the shell of this color, seem to be more easily excreted from the surface of the body, than the particles of fluid which go to the formation of any other color. It is observed that the body of the animal is covered with this fluid long before there is any appearance of secretion about the neck. This liquid is extended to the neck, and this produces a new layer of white shell; but as this layer is extremely thin and transparent, it does not prevent the usual secretion of the coloring matter at the neck to appear. In this period of the process if the animal retire within its shell, the new layer, still adhering in many points to its body, and not having acquired sufficient solidity, will be distorted and wrinkled; and not only exhibit that inequality of surface which generally appears in shells thus formed, but this arrangement of stripes or colors will also be destroyed.

It would be a very false conclusion from this account of the mode of the formation of the stripes which appear on certain species of shells, that the external surface of all shells should be marked with colors, or should be uniformly of the same color; and that there should be no shells whose external surface is marked with different spots, differently arranged, of an irregular figure, and separated from each other by unequal intervals. For if it has been shown that these colors are produced on the surface of the shell, only by means of the secretory organs, situated on the neck of the animal, it cannot be supposed that the same effects will follow, unless the animal is placed in the same circumstances. These secretory organs, therefore, must exist during the entire formation of the shell, to furnish the same quantity of coloring matter during the whole of its progress. But if it happen, on the contrary, that these organs undergo any change; if the pores through which the liquid is poured to form a shell or part of a shell of a brown color, become too large or too small, or in other respects change their form, after having poured out a certain quantity of this fluid; and that those which furnish the fluid of which the white part of the shell is composed, are also changed, it must happen that the shell which is produced is marked with different black and white spots, combined with a degree of irregularity corresponding to the change on the secretory organs. This will appear to be the case, by attending to the changes which take place in the secretory organs of snails which produce colored shells; for in them it may be observed, that the colors are dis-

tinct and well marked in some, towards the opening, while they are scarcely perceptible on the first turn of the spire towards the tip of the shell; and these changes of color cannot be supposed to exist without a corresponding change on the secretory organs.

The fluidity of the liquid for the formation of the shell has probably also some effect in the regular distribution of the colors which appear in some species. It is easy to imagine that some animals may secrete a fluid for the formation of the shell, of such a degree of fluidity as to flow easily from one place to another, and thus produce irregular marks on the shell. But besides, if there are secretory organs situated on the neck of the animal, which prepare fluids of different colors; if the animal moves, or is disturbed by any means, when these fluids are excreted on the surface, the colors will appear in a different place from their original distribution, or to be mixed and blended together, and thus occasion that irregularity which is observed in those parts of shells which have been last produced, or renewed.

But it will be necessary to have recourse to the first of these causes, namely, to the change of structure in the secretory organs of the neck, to explain the regular distribution of the round spots, or of those of a square or rectangular figure, with which certain shells are marked, and to suppose that those vessels which are arranged in a square or rectangular manner, which furnish peculiar fluids, are shut or open at different periods. It may happen that the developement of a great part of the animal, occasioned by a more vigorous growth in certain species than in others, may, in some cases, be the only cause of those regular spots, sometimes white on a colored ground, and sometimes colored on a white ground, which the shell exhibits, if the glands which secrete the coloring matter correspond in their distribution, to that of the divisions on the shell, and if they occupy a greater space on the neck than is usual in other species. In this way may be accounted for, the regularity of those marks, and the increase of their size, which is usually proportioned to that of the turns of the spire, from the consideration of the secretory organs of the animal enlarging in the same proportion as the other parts of its body; and their effects in the formation of the shell corresponding to the developement of those parts. Hence it follows, that the largest marks are observed on the external convolutions of the shell.

According to Reaumur, the last layer of the shell which is formed from a fluid secreted from that part of the surface of the animal's body which does not reach the neck, should be white, and this is most generally the case. In those shells which are inter-

22

nally colored, the fluids secreted from the body of the animal are of the same color, and they take the place of those which are usually white, or of a pearly nature, as is observed in many others. The nature of these internal layers is always obvious; for if they are not white, they exhibit everywhere an uniform color, and never variegated, like what appears externally. By removing with a file any part of the external surface of the shell, the layers which appear immediately under the surface, as those which have been furnished by the body of the animal, while those on the surface itself, usually more variegated than the rest, owe their formation to the vessels about the neck, and have been formed in the way already described.

The growth of shells, being proportioned to that of the inhabitant, proceeds almost imperceptibly. In most shells, however, it is easy to distinguish the different additions which they have received; for they are marked on their convex surface with different eminences which are parallel to each other, similar to lines of different degrees of depth, which give the shells a fibrous struct ure. These elevations called *striæ*, may be traced through the whole of the shell in bivalves, and in the longitudinal direction of those which have a spiral form. From the slightest observation of the manner in which shells are formed, it is easy to see that they can receive no addition, without leaving, in a greater or less degree, some trace of these irregularities; for every small addition of testaceous matter which is made, must be attached to the old part of the shell, which consequently must be more elevated than the former, whatever be its thickness, when the enlargement of the animal requires the formation of the latter. Thus the shell will be marked with a great number of these striæ, parallel to each other, which may be distinctly seen on many different species.

Every shell has usually some of these eminences at greater distances, and more elevated than the others. By these the different periods when the shell ceased to increase, or rather those when its growth was interrupted, are marked; and they have some degree of analogy with the different shoots from the branch of a tree. The heat of summer or the cold of winter interrupting the growth of the animal, at least among such as are testaceous, which live on the land, or inhabit rivers in temperate regions, the shell is not enlarged in extent during these seasons. It is otherwise, however with regard to its thickness, for there is continually exuded from the body of the animal, small quantities of fluid, which increase its thickness. Hence it is when the shell begins to increase in extent, the edge to which the new portion is cemented,

is much thicker than when the growth was gradual and imperceptible, and consequently the place at which the growth commences, after a long interruption, is distinguished by a more elevated ridge, than in the continual progressive additions which it receives. The numerous instances of this interruption in the growth of shells, will occur to the attentive conchologist in the progress of his researches. We know of a cabinet containing a fine illustration of the same thing, in a specimen of *Murex ramosus*. The animal, it would appear from the original part of the shell, had been for some time in a sickly or unhealthy state; for it has undergone many of the changes to which dead shells are subject. It has lost its enamel; it seems to have undergone some degree of decomposition, and some species of *serpula* and other parsaitical animals had made it their abode; but from this sickly state it seems to have recovered, and acquired great vigor; for the next addition which is made to the shell, is equal to its original bulk. It is clean, entire and in perfect preservation, forming a singular contrast with the old shell.

The place at which shells begin to increase, after the growth has been for some time interrupted may be distinguished by a difference of color in the stripes with which the shell is usually marked. In these places, black or brown stripes exhibit more vivid colors, and sometimes even little different from those on the rest of the superior surface of the shell. The cause of this change is not difficult to trace if we recollect that the secretory organs which prepare the coloring matter, at least in the *Helix nemoralis* have their origin at some distance from the extremity of the neck, from which we have seen that the first layer of shell which is traced to the extremity itself, should be of a different color from that of the stripes; but as the increase of the animal occasions the stripes to be formed under this first shell, during which it is still very thin, and consequently transparent, it does not prevent the shell produced under it, of a black color, to appear so. But when the animal has ceased to grow for sometime, it then increases the thickness of the shell last formed, so that the shell which is next produced from the coloring matter, when the animal begins to grow, being laid on one part of the old shell much thicker and less transparent, the color of these stripes must appear less bright, and therefore different in those places, from the other parts of the shell.

In taking a review of what has been said concerning the production of the colors of shells, it must appear that these rays or colored lines are owing to glands which secrete the coloring fluid, and which are arranged on the anterior edge of the neck, while

the posterior part furnished only a fluid of a different color, and usually less deep than the first. By means of this principle it is not difficult to account for the arrangement of the different colors which are so splendidly exhibited among this class of natural objects. These colors may be reduced to one or more, which are more vivid on a lighter ground; to colored, circular bands on a ground of a less vivid color, or pure white; to longitudinal lines, round or square spots, and in a regular, or irregular zigzag form. All these may be easily explained, according to the principles which have been laid down, the application of which, from what has been said, will not, we hope, be found difficult.

But from this mode, which is the most general in the production of the colors of shells, there are certain deviations. In that division of shells which is made by some naturalists, and which is distinguished by the name of *porcelain shells*, on account of the fine enamel with which they are covered; there are two sets of colors, which are disposed in a parallel direction to each other. The external range of these colors is owing to a peculiarity of structure in the animals which inhabit them, different from that of other testaceous animals, and to an operation which does not take place in other shells. In these shells the coloring matter seems to be deposited in two different ways, and at two different periods. In the first process, when the body of the shell is formed, the coloring matter is excreted from the glands, in the same way as in other testaceous animals; and it is arranged according to the disposition of the glands on the body of the animals. At this period of the process the shell is only of a moderate thickness, and much less than what it afterwards acquires, when completely formed. On the external surface of the shell first formed, another layer is deposited, which is more compact than the first, in some places thicker, and usually variegated with different colors. The external surface of the shell being thus completely covered with this second layer, the original colors are concealed; and if the same shell were examined at different periods of its formation, it would appear like two distinct species. The organs which are employed by the animal in the production of this second layer of shell, and set of colors, are two soft, membranaceous wings, which being protruded from the opening of the shell, completely cover the whole of its external, convex surface. These two wings, which are quite distinct from the glandular structure about the neck of the animal, which is situated a little lower, are also provided with glands, which furnish coloring matter, usually different from that which is furnished by the glands of the neck and it is the upper surface of the wings, which is alone provided

with this glandular structure. This surface, when this part of the animal is protruded from the shell and extended over it, comes in contact with the external surface of the latter. Hence it is, that these membranaceous organs deposit on the first formed and colored layers of the shell, new layers of testaceous matter, which is differently colored, and diversified with entire spots, either circular or in a waved direction, which are sometimes of a more vivid tint than that of the ground, or white upon a dark ground, or brown upon a yellow ground; or are composed of straight lines, or curved or interlaced with each other, reddish brown, yellow or white; on different colored grounds, or in dots or points, whose shades and arrangement are not less diversified.

This mode of the formation of the external layer of porcelain shells, has been proved by the actual observations of some naturalists. In some species, a longitudinal line of a paler color is observed on the convex surface of the shell. This is ascribed to the junction of the two wings of the animal, where a smaller quantity of coloring matter has been deposited, or where the shell has been less completely covered with the protruded part of the animal. But the existence of this second layer is still more distinctly proved by mechanical means.

The external layer may be removed by means of a file, and the shell restored to its original state; and then the colors which it first received are brought into view. This circumstance is still farther demonstrated by an attentive examination of different species of shells, and particularly the *Cypræa argus*. In examining this shell, there are observed under the external layer, which is of a yellow color, some slight traces of four transverse bands of a brown color, which surround the shell, and which must have been formed previous to the more superficial yellow layer. By a more minute examination, it will appear that the circular spots, with which the external yellow layer is marked, have been posteriorly formed to this layer; and finally, on the four turns of the spire forming a slight projection at the base of the shell, there are some brown, circular spots, which are quite superficial, and which sometimes include two turns of the spire, which could not happen if the yellow color had not been prior in its formation to these circular spots. If the coloring matter of which these spots are composed had been deposited at the time that the different parts of the spire were formed, one spot could not have included two turns of the spire at the same time.

This effect of communicating a new set of colors to the external surface of the shell, is not the only one which is produced by the membranaceous structure of the animal which inhabits the

porcelain and other shells. The form of the shell is also changed in a remarkable manner, a great quantity of testaceous matter being deposited on the surface of the opening, which then assumes a considerable thickness. The turns of the spire are incrusted, and sometimes disappear on the outside of the shell; and wrinkles, furrows, and even tubercles, which exist on the surface of some species, are also formed. The surface of the *Cypræa pediculus* exhibits circular striæ which did not originally exist, which owe their formation to this cause. In other species, the surface is marked with projecting points or tubercles, which are produced in the same manner as the circular striæ of the former, and which also depend on the structure of the membranaceous wings of the animal and the testaceous substance which is secreted and deposited from their surface. Thus, it appears that porcelain shells, and those of some other species, are formed at two distinct periods. It is during the second period of the process that the color of the complete shell is formed. In farther illustration of this point, of the formation of shells of this description at two different periods, one or two examples may be given of the difference which takes place, when the last layer formed is removed. In the *Cypræa exanthema*, the shell is ferrugineous, with whitish, round spots and eyes, but when the outer coat is worn off, it becomes barred or tessalated with brown or blue. The *Cypræa arabica*, as its name imports, exhibits characters on its surface, having some resemblance to Arabic letters. The ground on which these characters, which are of a brown color are placed, is whitish or bluish; yet when the outer coat is worn down, the shell is sometimes marked with blue or brown bands, or pale with darker angular spots and lines; brown, mixed with violet, or reddish blue.

But besides the causes which have been mentioned concerning the production and variety of the colors of shells, arising from the difference of structures in the organs which secrete the coloring matter, and the changes to which these organs are subjected in the growth of the animal, the effects of light and heat, altogether independent of the animal itself, are probably very considerable. Two individuals of the same species, the one from the Mediterranean or European seas, and the other from the tropical regions, exhibit very different shades of colors. The colors of the inhabitants of the torrid zone are always more bright and vivid than those of the natives of more temperate climates. The two shells, although similar in form, size and other characters are uniformly different in the intensity of their colors. These differences, which have led conchologists to increase the number of species, obviously depend on the action of the climate, and particularly of light, on nourish-

ment, and other circumstances which have hitherto eluded the observation of naturalists, and are uniform and constant, as long as the causes which operate in their production, continue to act. At first sight it might be supposed that the difference of temperature is the difference in the intensity or color, in shells produced in different climates. It might be supposed too, that the different depths at which shells are found in the ocean, the medium in which they live being thus very different, would occasion great diversity in color. Near the surface, where the heat is greatest, if the operation of this cause were considerable, the colors of shells should be expected to be most vivid, and as the depth increased, at least to a certain extent, the intensity of color should be diminished. But it has been observed in bivalve shells which are found at great depths, such as some species of oyster and spondylus, that the lower valve, which is attached to the rock, is almost always white or colorless, while the upper valve often exhibits bright and vivid colors; but this difference cannot be ascribed to the difference of temperature, for in both valves it must be the same as the matter secreted, for their formation is prepared by the same organs, and is deposited in a similar manner; and indeed they are altogether placed in the same circumstances, and the same causes, excepting that the upper valve is exposed to the rays of light, and is therefore colored, while the lower valve is removed from the action of this cause, and is colorless.

The same difference is observed in the valves of other shells, which are produced in similar circumstances. The different species of pholas which make their abode in calcareous or coral rocks, and the *Teredo navalis* or ship worm, which pierces wood, and makes it its habitation, are usually colorless. Those testaceous animals too, which live at great depths in the ocean, and are thus far removed from the influence of light, are also distinguished by very white colors, or are entirely white.

ORNITHOLOGY.

NO. VI.

Incubation. It is probable birds are endowed with an instinctive power of regulating the necessary heat for this purpose; of course, should the heat of the air, together with the natural warmth of the body, on the close contact of the bird to the eggs, be too

great, her feelings would dictate the necessity of leaving them for a time to cool. At the early period of incubation birds quit their eggs more frequently than at the time the *fœtus* is more perfect. Yet, in the advanced state, the embryo young is not in more danger of being destroyed, if so much ; for a living fœtus is frequently found that has been taken from the nest two days. If, however, the young is within a few hours excluded, and the egg is suffered to be sometime cold, it either dies, or becomes so weak, as not to be able to extricate itself from the shell. Various degrees of heat will enlarge the embryo young, but regular heat seems necessary to its production; and yet artificial heat, regulated by the brooding of a bird, will not produce young with certainty. In Egypt, a vast quantity of eggs are hatched by artificial heat in stoves. It is probable, however, one third or one fourth miscarry.

The male birds of some species supply the place ofthe females on the nest; but then it is of short duration, and rarely, if ever, when eggs are near hatching: at that time the female is frequently fed by the male. This is not common to all species, but very conspicuous in the rook, the pigeon and many others. Many species of birds possess a *reservoir* for food, called a *craw*, or *crop;* this seems to answer the same purpose as the first *stomach* in ruminating animals. Here it is the food is softened and prepared for the stomach; from this reservoir it is by some ejected for the purpose of feeding their young; conspicuous in the pigeon.

The rook has a small pouch under the tongue, in which it carries food to its young. It is probable the use of the craw may be extended further than is generally imagined; for, besides the common preparation of the food to assist its digestion in the stomach, there are some species that actually secrete a lacteal substance in the breeding season, which, mixing with the half-digested food, is ejected to feed and nourish the young. The *mammæ*, from which this milky liquor is produced, are situated on each side of the upper part of the breast immediately under the craw. In the female turtle dove, these glands are tumid, with milky secretions, and we believe it common to both sexes of the dove genus. The comorant or pelican genus possess no craw; but to supply its place, they have a loose skin at the base of the under mandibles, capable of great distention, in which they carry fish to their young.

We shall conclude this article by givlng an account of Malpighi and Haller's experiments on the hatching of a hen's egg.

Previous to putting the eggs to the hen, they first examined the cicatricula, which they considerde as the most important part of

egg. This, which some call the *punctum saliens*, or *punctum vitæ*, was found in those that were impregnated by the male to be large but in the others small. Upon examination with the microscope it was found to be a kind of bag, containing a transparent liquor in the midst of which the *embryo* was seen. The embryo resembled a composition of little threads, which the warmth of future incubations tended to enlarge.

Upon placing the egg in a proper warmth, after six hours the *vital speck* begins to dilate like the pupil of the eye. The head of the chicken is distinctly seen, with the back-bone something resembling a tadpole floating in its ambient fluid, but as yet seeming to assume none of the functions of animal life. About six hours more the little animal is seen more distinctly; the head becomes more plainly visible, and the vertebræ of the back more easily perceivable. All these signs of preparation for life are increased in six hours more; and, at the end of twenty-four, the ribs begin to take their places, the neck begins to lengthen, and the head to turn to one side.

At this time, the fluids in the egg, seem to have changed places; the yolk which was before in the centre of the shell, approaches nearer the broad end. The watery part of the white is diminished, the grosser part sinks to the small end; and the little animal appears to turn towards the part of the broad end in which a cavity has been described, and with its yolk seems to adhere to the membrane there.

At the end of forty hours the great work of life seems fairly begun, and the animal plainly appears to move; the back bone thickens; the first rudiments of the eyes begins to appear; the heart beats, and the blood begins already to circulate. The parts, however, as yet are fluid, but by degrees, become more and more tenacious. At the end of two days, the liquor in which the chicken swims, seems to increase; the head appears with two little bladders in place of eyes; the heart beats in the manner of every embryo where the blood does not circulate through the lungs. In about fourteen hours after this, the chicken is grown more strong; the veins and arteries begin to branch, in order to form the brains; and the spinal marrow is seen stretching along the back bone. In three days, the whole body of the chicken appears bent; the head with its two eye-balls, with their different humours, now distinctly appear; and five other vesicles are seen, which soon unite to form the rudiments of the brain. The outlines also of the thighs, and wings, begin to be seen, and the body begins to gather flesh. At the end of the fourth day, the vesicles that go to form the brain approach each other; the wings and

thighs appear more solid; the whole body is covered with a jelly like flesh; the heart that was hitherto exposed, is now covered up within the body, by a very thin transparent membrane; and at the same time, the umbilical vessels, that unite the animal to the yolk, now appear to come forth from the abdomen. After the fifth and sixth days the vessels of the brain begin to be covered over; the wings and the thighs lengthen; the belly is closed up, and turned; the liver is seen within it, very distinctly, not yet grown red, but of a dusky white; both the ventricles of the heart are discerned, as if they were two separate hearts, beating distinctly; the whole body of the animal is covered over, and the traces of the incipient feathers are already to be seen. The seventh day the head appears very large; the brain is entirely covered over; the bill begins to appear betwixt the eyes, and the wings, the thighs, and the legs, have acquired their perfect figure. Hitherto, however, the animal appears as if it had two bodies; the yolk is joined to it by the umbilical vessel that comes from the belly; and is furnished with its vessels, through which the blood circulates, as through the rest of the body of the chicken, making a bulk greater than that of the animal itself. But towards the end of incubation, the umbilical vessel shortens the yolk, and with it the intestines are thrust up into the body of the chicken by the action of the muscles of the belly, and the two bodies are thus formed into one. During this state, all the organs are found to perform their secretions; the bile is found to be separated, as in grown animals; but it is transparent, and without bitterness; the chicken then also appears to have lungs. On the tenth, the muscles of the wings appear, and the feathers begin to push out. On the eleventh, the heart which hitherto had appeared divided, begins to unite, the arteries which belong to it, join into it, like the fingers into the palm of the hand. All these appearances, come more into view, because the fluids the vessels had hitherto secreted, were more transparent; but as the colour of the fluids deepen, their operations and circulations are more distinctly seen. As the animal thus, by the eleventh day, completely formed, begins to gather strength, it becomes more uneasy in its situation, and exerts its animal powers with increasing force. For some time before it is able to break the shell in which it is imprisoned, it is heard to *chirrup*, receiving a *sufficient quantity of air for this purpose*, from that cavity which lies between the membrane and the shell, and which must contain air to resist the external pressure. At length upon the 20th day, in some birds sooner, and later in others, the enclosed animal breaks the shell within which it has been confined, with its beak; and by repeated efforts, at last procures its enlargement.

From this history we perceive, that those parts which are most conducive to life, are the first that are begun; the head and the back-bone, which no doubt enclose the brain, and the spinal marrow, though both are too limpid to be discerned, are the first that are seen to exist; the beating of the heart is seen soon after; the less noble parts seem to spring from these, the wings, thighs, the feet, and lastly the bill.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. VI.

'Gathering and sorting Cocoons. In either three or four days from the commencement of its labors the silkworm completes its cocoon, and in seven or eight days thereafter the balls are gathered. Some persons do not wait longer than three or four days ere they reap their silken harvest.

It is usual to begin by gathering from the lower tier of arbours. In this proceeding no violence should be used to disengage the twigs, which must be gently handled, and consigned to those whose employment it is to separate the cocoons. These persons, as they pick off the balls sort them; selecting those which are to be preserved for continuing the breed, and putting into distinct baskets all fine cocoons, those which are double, soiled, or anywise imperfect. The fine and well-formed balls are again subdived into white and yellow, the latter colour embracing every shade from the deepest yellow to those which are merely tinged. A very few will sometimes be found having a pale green hue. The cocoons of a bright yellow yield a greater weight of reeled silk than the others, but as their deeper colour results from the greater proportion of gum wherein the colouring matter principally resides, any advantage from this source accrues only to the grower, the gummy substance being all boiled out previous to the weaving of the silk.

'Raw silk which is of a pale colour is found to take certain dyes better, and is on that account very generally preferred.

'The selection of chrysalides for breeding is made from such cocoons as are perfectly sound, and whose threads appear to be fine; having their ends round and compact; and being a little de-

pressed in the middle, as if tightened by a ring or ligature. The reason given for attentions to these particulars, is the belief that worms producing such balls are of strongest constitutions. Count Dandolo was of opinion that too much stress is laid upon this point, and that all cocoons which are perfectly formed are alike desirable for breeding. For this purpose an equal number of males and females must be preserved. The former are distinguishable by being sharper at the ends, and this, although an unerring guide, proves sufficiently correct for all practical purposes. These cocoons are sometimes spread in thin layers on tables: but it seems a better practice, and one more generally adopted, is to string them together on a thread, care being taken not to pass the needle too deep into the silk. These strings, three or four feet in length, are then hung in festoons out of the reach of vermin. The floss is, in this case usually removed, as it is found to oppose additional difficulty to the moth in its extrication.

'In making the selection of cocoons for breeding, so as to insure the object of maintaining the number of his silkworms, the cultivator considers it necessary to set apart one sixtieth of his whole produce. This shows how considerable must be the loss sustained in this branch of the pursuit. If all the eggs produced by this proportion were found productive, the brood would by their means be trebled in the following season.

'The next proceeding is that of destroying the vitality of the chrysalides in those cocoons which are to be reeled. Various methods are employed for this purpose, according to the nature of the climate; the solar rays being in some instances found sufficient, no artificial means need then to be resorted to. In this case, a calm and cloudless day is chosen, and the cocoons are left exposed to the scorching beams of the sun, during four or five hours in the middle of the day. They are next closely inwrapt in coarse cloths which have been exposed to the same heat, black cloths being chosen preferably on account of their absorbing a greater quantum of heat. These processes being seperated during several days, the destruction of the insect is usually attained. It is not safe, however, without examination, to confide in its efficacy; for this trial a few chrysalides must be stripped and pricked with a needle. If upon this they give no sign of animation, it may be safely concluded that their suffocation has been perfected.

'In more temperate regions artificial means must necessarily be employed, and recourse is therefore had to the heat of steam, or of an oven; and most frequently the latter method is adopted, although there is no reason to doubt that the other, provided it could be efficaciously applied by means of convenient apparatus,

would be more quick and certain in its operation, as well as productive of less injury to the texture of the silk. When the oven is used, the cocoons are placed in long shallow baskets, filled to within an inch of their tops, and covered, first with paper, and then with a cloth wrapper. The heat of the oven wherein the baskets are disposed has not been more precisely defined, than that it should be *very nearly* that of an oven from which loaves of bread have just been taken after being baked. The worms are exposed to this heat during an hour; and on their being withdrawn, it is ascertained by the examination of chrysalides, taken from the centre of each basket, whether the vitality of the worms is destroyed. Those chosen for examination having been, from their position, the least exposed to the heat, it is fairly presumed that if these be dead the whole are equally destroyed. On their removal from the oven, the baskets are wrapped in woolen cloths or blankets, and piled on each other. If the baking has been properly conducted, the blankets will soon appear profusely covered with moisture, and if this should not be seen, the baking has been either excessive or insufficient. If too great, the worms and cocoons will have been previously so much dried as to leave no further moisture to transude; if too little, the heat has not sufficiently penetrated to distil the liquor which the chrysalides contain, and the worms, in that case, will not be deprived of vitality.

'It is obvious that very great nicety is required to limit the degree of heat to the exact point that will kill the chrysalides, and it is of great importance that this point shall not be exceeded, as the silken filaments would by such means be injured. For this reason steam would doubtless be much more frequently used, if any simple apparatus were introduced for the purpose. Where this agent is now employed, its efficiency is so limited that the operation is troublesome and the result uncertain.

'A large wooden vessel is provided, into which boiling water is poured to the depth of two feet. This vessel has within it a wicker hurdle, entirely covering the water, and supported about one inch distant from its surface. The bottom of this hurdle is provided with a coarse porous cloth, easily penetrable by steam: on this the cocoons are placed, and are covered well over to confine the heat. When the water has become so cool that it no longer emits a body of steam, it must be changed for other boiling water; and it is considered necessary to continue this steaming process for two hours, before the destruction of the chrysalides can be considered certain. If steam were differently applied, a few minutes would suffice for perfecting this object. The cocoons,

when removed from the steaming vessel, are covered over with the same care as is employed after baking, and they are left to cool very gradually. After this they are spread out in the air and sun to dissipate the moisture they have imbibed.

'It is always desirable, where time can be alloted to the purpose, that the process of reeling should be performed without the delay which renders this destruction of the worms necessary. This, in large establishments, is evidently impracticable as regards any very considerable proportion of the produce; but it must be always performable to a certain extent; and it is proper to give the preference, in this respect, to such cocoons as appear the weakest: the others, which contain a greater proportion of gum, are thence better qualified to sustain heat without injury.

'When the process, however conducted, for destroying the worms has been perfected, the cocoons are placed on shelves, and must be continually turned and looked over, lest they should become mouldy. If any appear spotted or otherwise damaged, they must be separated to prevent the injury spreading to those balls with which they are in contact, and should be immediately reeled to stay the progress of their own destruction. Large establishments for producing silk comprise in them buildings exclusively appropriated to this purpose, and which are called *coconieres*. These are rooms fitted up with ranges of shelves from two to three feet above each other, and the whole are insulated from the wall and roof, lest the place should be invaded by rats or mice, which would infallibly destroy the cocoons in their eagerness to reach the chrysalides, of which they are immoderately fond. Still farther to guard against this havoc, the legs of the framing which supports the shelves should be enveloped in some furzy or prickly substance.

'After the separation of cocoons for breeding, the gathering is divided into nine different qualities.

'*Good cocoons* are those which have been brought to perfection: these are by no means the largest, but are compact and free from spots.

'*Pointed cocoons* have one extremity rising in a point: these, after affording a little silk in reeling, break or tear at the point where the thread is weak, and they cannot be wound further, as their fracture would occur as often as the thread reached the weak point.

'*Cocalons* are rather larger than regular cocoons but do not contain more silk, their texture being less compact. These are separated from the other kinds, because in winding they must

be immersed in colder water, to avoid any furzing or entangling in the operation.

'*Dupions or double cocoons.* The threads of these are so intertwined, that frequent breakings occur in reeling, and sometimes they cannot be wound at all. In any parcel of cocoons the proportion of these will usually amount to one per cent.

Soufflons. These are very imperfect cocoons with a loose contexture, sometimes even to so great a degree as to be transpaent: these cannot be wound.

'*Perforated cocoons*, as their name denotes, have a hole in the end, and for that reason cannot be reeled, as the filament is found, to be broken whenever it arrives at the perforation.

'*Good choquettes* are concoons wherein the insects have died before perfecting their task. These are known by the adhesion of the worm to the cocoon, which prevents its rattling when shaken. The silk of these is as fine as of the first-mentioned quality, but not so strong nor so brilliant, and they must be wound separately, as they sometimes furze in reeling.

'*Bad choquettes* are defective cocoons, spotted or rotten. They furnish foul bad silk, and of a blackish color.

'*Calcined cocoons* are those wherein the worms after having completed their cells, are attacked by a peculiar disease, which sometimes petrifies them, and at other times reduces them to a white powder. In the former case they are called comfit cocoons from the resemblance which is borne by the withered worm to a sugar-plum. The quality of the silk, so far from being injured by this means, is generally excellent, and is even in greater quantity than in the cocoons of healthy worms. Comfit cocoons may be distinguished by the peculiar rattling noise of the worms when shaken: they are so much esteemed in Piedmont, that they sell for one half more than good cocoons. They are not of frequent occurrence, and it is very rarely that so large a parcel as twenty-five pounds is met with.

'The cocoons of the mountains are considered better than those produced on the plains: there is a greater proportion of white found among them; and although the balls are not so large, the worm is proportionally smaller than usual.

'The relative value of cocoons, as stated in the paper already quoted from the American Philosophical Transactions is as follows:—

Good Cocoons - - -	100
Perforated - - - -	33 1-3
Soufflons - - -	25
Royal cocoons, for seed - -	250
Royal cocoons, not chosen for seed	200

Cocoons lose in weight about seven and a half per cent. in the course of ten days by the desiccation of the chrysalis: to those, therefore who sell their cocoons previously to reeling, it is an advantage to dispose of them as soon as gathered. In one thousand ounces of perfect cocoons, the chrysalides weigh eight hundred and forty five ounces, the envelopes cast by the worms on becoming chrysalides four and a half, and the pure cocoon one hundred fifty and a half ounces. Thus each healthy cocoon, as it is gathered, contains more than the seventh part of pure cocoon; but the quantity of reeled silk obtained, seldom averages more than one twelfth in weight of the gathered cocoons. Mayet reckons, that if they are of superior quality, ten pounds of cocoons will produce one pound of silk; but that it more generally requires eleven or twelve pounds as gathered, to yield that quantity. The same author likewise estimates two hundred and fifty cocoons to weigh one pound: count Dandolo found that two hundred and forty of his made up that weight.

'If no loss be sustained either in hatching the eggs or in rearing the worms, it is possible to obtain from each ounce of eggs one hundred and sixty-five pounds' weight of cocoons: whatever less in weight is derived from this quantity of eggs indicates the exact amount of loss and damage sustained. In some parts of Italy, where the mode of management is very defective, only forty-five pounds of cocoons are obtained from each ounce of eggs: the average quantity is about one hundred pounds. Count Dandolo usually acquired on his establishment, from this weight of eggs, about one hundred and forty pounds of fine picked cocoons, in addition to the coarse floss with which they are surrounded.

'In the year 1790, the Society for the Encouragement of Arts, &c. adjudged their gold medal to Mr. Salvator Bertezen, for his having produced five pounds' weight of silk from worms reared in England. This gentleman professed to have a superior breed of worms, and that his manner of managing them was also better than that usually followed. The above quantity of silk, which was wound in seven to nine fibres, was said to be the produce of twelve thousand worms. This fact was much controverted at the time, and the quantity was deemed excessive with reference to the number of worms; but there now appears to be little reason for doubting its correctness, as the proportion very nearly agrees with the recorded experience of count Dandolo.

'This nobleman gives many elaborate calculations in his volume, the results of some of which may be found interesting. According to his experience, about ninety-seven and a half pounds of

mulberry leaves will suffice for the production of seven and a half pounds of cocoons: these will yield about eighteen ounces of pure cocoon, from which only ten ounces of reeled silk are generally obtained. Thus the proportion between the weight of mulberry leaves consumed, and that of the pure cocoon produced, is about eighty-seven to one; and the proportional weight of mulberry leaf and of reeled silk is as one hundred and fifty-two to one. The ratio between the quantity of reeled silk drawn from the cocoon and the cocoon itself, may be greatly affected by the good or ill management to which the worm is subjected.

In the year 1814, when the season was extremely unfavourable to the rearing of silkworms, the count obtained fifteen ounces of very fine silk from seven and a half pounds of cocoons, and thirteen ounces from the same weight of refuse cocoons. This fact speaks very highly for his excellent management. The proportion between the weight of silk which can be reeled, and the coarse floss which can only be spun, should, in perfect cocoons, be in the average ratio of nineteen to one. In addition to this proportion of refuse floss, there is likewise to be gathered the outer floss, which is a loose, furzy texture, spun by the worms preparatory to the formation of their balls: the nature of this substance, together with the injury that it sustains in its disengagement from the arbours, entirely prevent its being reeled. It is usually in the proportion of about four to eleven with the silk of the cocoon.

The weight and length of reeled silk that can be obtained from each cocoon are very variously stated by different authors: in fact, the quantity is found to vary considerably, depending on many circumstances attendant on its formation. Some statements on the subject have been extravagantly absurd. Among others, Isnard, an old author, who has been before quoted, and whose delight in the marvellous has, on this point, found rivals even in the present day, affirms that the silk of one cocoon, when drawn out, will measure six miles in length, that is ten thousand, five hundred and sixty yards! Count Dandolo, at once, contracts this measurement more within the limits of probability. He found that a silkworm's labours seldom exceed the production of six hundred and twenty-five yards;* an astonishing quantity, when we reflect upon the brief period employed by so small a creature in its production. Surely it is unnecessary to call in the aid of exaggeration more highly to excite our wonder.

Miss Rhodes of Yorkshire found that one of her largest cocoons measured four hundred and four yards. Pullein considers the

* 1760 French feet.

average to be three hundred yards. Miss Rhodes found that her cocoons weighed three grains each. Count Dandolo calculates the weight to be three eighty-four hundredths grains, equal to about three and a fourth English grains.

'The size of an ordinary cocoon of good quality is about an inch in its largest diameter, and one third less in its smallest diameter. The largest diameter of dupions is an inch and a quarter, and their smallest diameter three quarters of an inch.

'The attendance required for the care of silkworms does not wholly occupy the time of those employed, and it is, therefore, difficult to ascertain its amount with correctness. Pullein states, that for rearing the worms produced from six ounces of eggs two attendants are necessary until the fourth age, and that after this period five or six persons are required. Count Dandolo, with his accustomed accuracy, reduces the time required for attendance upon the produce of five ounces of eggs to an equality with one hundred days' continuous labour of one individual.

'From these data it is found, that to obtain one pound of reeled silk it requires twelve pounds of cocoons; that rather more than two thousand eight hundred worms are employed in forming these cocoons; and that to feed these during their caterpillar state, one hundred and fifty-two pounds of mulberry leaves must be gathered. This pound of reeled silk is capable of being converted into sixteen yards of gros de Naples of ordinary quality, or into fourteen yards of the best description.

'Experience has shown that some regulation of temperature is necessary in producing the moths from the cocoons. If the heat in which these are placed be above seventy-three degrees, their transition would be too rapid, and their productiveness would be lessened: on the other hand, if the temperature be below sixty-six degrees the developement of the moths is tardy, and their produce equally falls below the due proportion.

'The moths should begin to issue from their concealment in about fifteen days. The female deposits her eggs upon sheets of paper, or strips of linen, which are then hung in a cool situation, and when dry are preserved in an airy place, and securely shielded from damp and from vermin. In making choice of a situation wherein to store these eggs for the winter, although it is necessary to keep them cool, that premature hatching may be avoided, it is, on the other hand, indispensably requisite to preserve them from too intense a degree of cold: a temperature wherein water will freeze would be infallably destructive to their vitality.

THE BUTTERNUT.

Juglans cathartica.

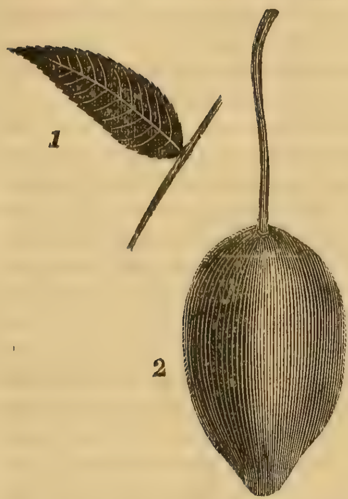


Fig. 1. A leaflet. Fig. 2. A nut with its husk.

THIS species of walnut is known in the United States, under different denominations. In Massachusetts, New Hampshire and Vermont, it bears the name of *Oil Nut*; in Pennsylvania and Maryland and on the banks of the Ohio, it is generally known by that of *White Walnut*; in Connecticut, New York, New Jersey, Virginia, and the mountainous districts of the upper parts of the Carolinas, it is called *Butternut*. The last of these names we have adopted, because it is most generally used. This tree is found in the Canadas, in all of the New England States, New York, New Jersey, Kentucky, Tennessee and on the banks of the Missouri, and in the bottoms which border on the Ohio. It flourishes most abundantly in a cold unproductive soil, interspersed with large rocks, and on the steep, elevated banks of rivers.

In favorable situations this tree grows to the height of fifty or sixty feet with a circumference of ten or twelve feet, five feet from the ground. Its roots extend even with the surface of the earth, in a serpentine direction, and with little variation in size, to the distance of forty feet. The trunk ramifies at a small height, and the branches, seeking a direction more horizontal than those of other trees, and spreading widely, form a large and tufted head, which gives the tree a remarkable appearance. The bark of the secondary branches is smooth and grayish. The buds, like those of the black walnut, are uncovered. In spring its vegetation is forward, and its leaves unfold a fortnight earlier than those of the hickories. Each leaf is composed of seven or eight pair of sessile leaflets, and terminated by a petiolated odd one. The leaflets are from two to three inches in length, lanceolate, serrate and slightly downy. The barren flowers stand on large cylindrical aments, which are single, four or five inches long, and attach-

ed to the shoots of the preceeding year; the fertile flowers, on the contrary, come out on the shoots of the same spring, and are situated at the extremity. The ovarium is crowned by two rose-colored stigmas. The fruit is commonly single, and suspended by a thin, pliable peduncle, about three inches in length; its form is oblong-oval without any appearance of seam. It is often two and a half inches in length, and five inches in circumference, and is covered with a viscid adhesive substance, composed of small transparent vesicles, which are easily discerned with the aid of a lens. The nuts are hard, oblong, rounded at the base, and terminated at the summit, in an acute point; the surface is very rough, and deeply and irregularly furrowed. They are ripe from the middle to the end of September, a fortnight earlier than the other species of walnut. The kernel is thick and oily, and soon becomes rancid; hence, doubtless, are derived the names of *Oil nut* and *Butternut.*

The black walnut and butternut, when young, resemble each other in their foliage, and in the rapidity of their growth; but when arrived at maturity, their forms are so different, as to be distinguishable at first sight. Remarkable peculiarities are also found, on examining their wood, especially when seasoned; the black walnut is heavy, strong, and of a dark brown color; while the butternut is light, of little strength, and of a reddish hue; but they possess in common, the great advantage of durability, and of being secure from the annoyance of worms. From its want of solidity and from the difficulty of procuring pieces of considerable length, the timber of the butternut is seldom used in the construction of houses. As it long resists the effects of heat and moisture, it is esteemed for the posts and rails of rural fence. For corn shovels and wooden dishes, it is preferred to the red-flowering maple, because it is lighter and less liable to split. In Vermont, it is used for the panels of coaches and chaises; the workmen find it excellently adapted to this object, not only from its lightness, but because it is not liable to split, and receives paint in a superior manner.

The medicinal properties of the butternut bark, have long since been proved, by several eminent physicians of the United States. An extract in water, or even a decoction sweetened with honey, is acknowledged to be one of the best cathartics afforded by *materia medica*; its purgative operation is always sure, and unattended, in the most delicate constitutions, with pain or irritation. Experience has shown that it produces the best effects in many cases of dysentery. It is commonly given in the form of pills, and to adults, in doses from half a dram to a dram. It is not however in

general use, except in the country. It is obtained by boiling the bark entire in water, till the liquid is reduced by evaporation, to a thick, viscid substance, which is almost black. This is a faulty process ; the exterior bark, or the dead part which covers the cellular integument, should first be taken off, for by continued boiling, it becomes charged with four-fifths of the liquid, already enriched with extractive matter. This bark is also successfully employed as a revulsive, in inflamatory ophthalmias and in the tooth ache: a piece of it soaked in warm water, is applied in these cases to the back of the neck. In the country it is sometimes employed for dying wool of a dark brown color; but the bark of the black walnut is preferable. On a live tree, the celcular integument, when first exposed, is of a pure white, in a moment it changes to a beautiful lemon color, and soon after to a deep brown. If the trunk of this tree is pierced in the month which precedes the unfolding of the leaves, a pretty copious discharge ensues of sugary sap, from which, by evaporation, sugar is slightly obtained inferior to that of the sugar maple. *Sylva Americana.*

THE CHERRY TREE.

THIS tree was procured and brought into Europe by the overthrow of Mithridates, king of Pontus, when he was driven from his dominions by Lucullus, the Roman general, who found the cherry tree growing in Carasus, a city of Pontus, now called Keresoun, a maratime town belonging to the Turks in Asia, which his army destroyed, and from whence it derived the present name of *cherry*. Lucullus, who was as great an admirer of nature as he was of the arts, thought his tree of so much importance, that when he was granted a triumph, it was placed in the most conspicuous situation among the royal treasures which he obtained from the sacking of the Capitol of Armenia; and we doubt much if there was a more valuable acquisition made to Rome by that war, which is stated by Plutarch to have cost the Armenians one hundred and fifty-five thousand men: we may justly style it the fruit of the Mithridatic war.

Botany seems to have been as much studied in early times by distinguished persons as at present. In this instance we find the conquered and the conqueror both botanists. Mithridates, whom Cicero considered the greatest monarch that ever set on a throne, and who had vanquished twenty-four nations whose different lan-

guages he had learned, and spoke with the same ease and fluency as his own, found time to write a treatise on botany in the Greek language. His skill in physic is well known; there is even at this day, a celebrated antidote, called Mithridate.

It was in the 68th year, B. C. that Lucullus planted the cherry tree in Italy, which 'was so well stocked,' says Pliny, 'that in less than twenty-six years after, other lands had cherries, even as far as Britain beyond the Ocean.'

Some idea may be formed of the Roman gardens, by the luxurious manner in which Lucullus lived in his retirement from Rome and the public affairs. He had passages dug under the hills, on the coast of Campania, to convey the sea water to his house and pleasure grounds, where the fishes flocked in such abundance, that what were found at his death sold for more than eight hundred thousand dollars. Pliny mentions eight kinds of cherries as being cultivated in Italy, when he wrote his Natural History, which was A. D. 70. 'The reddest cherries,' says he, 'are called *apronia;* the blackest, *actia;* the Cæcilian are round. The Julian cherries have a pleasant taste, but are so tender that they must be eaten when gathered, as they will not endure carriage.' The Duracine cherries were esteemed the best, but in Picardy the Portuguese cherries were most admired. The Macedonian cherries grew on dwarf trees; and one kind is mentioned by the above author, which never appeared ripe, having a hue between green, red and black. He mentions a cherry that was grafted, in his time on a bay tree stock, which circumstance gave it the name of *laurea;* this cherry is described as having an agreeable bitterness. 'The cherry tree could never be made to grow in Egypt,' continues Pliny, 'with all the care and attention of man.'

Lord Bacon has clearly elucidated what the ancients considered the sympathy or antipathy of plants. 'For it is thus,' says this great man, 'wheresoever one plant draweth such a particular juice out of the earth, as it qualifieth the earth, so that juice which remaineth is fit for the other plant; there the neighborhood doeth good, because the nourishments are contrary or several; but where two plants draw much the same juice, then the neighborhood hurteth; for the one deceiveth the other.

The cherry, like many other kinds of fruit has had its sorts so multiplied, by various graftings and sowing the seeds, that we now enjoy a great variety of this agreeable fruit, and for a considerable portion of the summer, as it is one of the first trees that yields its fruit, in return for the care of the gardener. From the ripening of the Kentish and the May Duke to the Yellow Spanish and the Morells, we may reckon full one third of the year that our

desserts are furnished with this ornamental fruit; and to those who have the advantage of housed trees, the cherry makes a much earlier appearance, as it is a fruit that bears forcing exceedingly well.

Cherries have ever been found more tempting than wholesome. Pliny says, ' this fruit will loosen and hurt the stomach; but when hung up and dried, has a contrary effect. He relates, that some authors have affirmed that cherries, eaten fresh from the tree when the morning dew is on them, and the stones being also swallowed, will purge effectually, as to cure those who have the gout in their feet.

The wood of the cherry tree, which is hard and tough, is next to oak for strength, and comes the nearest to mahogany in appearance.

Judiciously planted, the cherry tree is very ornamental in the shrubbery. Its early white blossoms are contrasted with the sombre shades of evergreens in the spring; and its graceful ruby balls give a pleasing variety in the summer.

East Indian Method of Making Ice.

Ice, in the East Indies, is considered so great a luxury, that the manufacture of it is a business of considerable consequence, as well as profit.

The workmen dig several large pits, perhaps thirty feet square, and about two deep,—the bottoms of which, they cover from eight inches to a foot thick with sugar cane, or the stems of the large Indian corn, dried.

On this bed are placed, in rows, a number of small shallow, unglazed earthen pans, formed of a very porous earth, a quarter of an inch thick, and about an inch and a quarter deep, which, at evening are filled with soft water, which has first been boiled.—In the morning, before sunrise, the ice makers attend at the pits, and collect what is frozen, in baskets, which is then conveyed to the place of preservation. This is generally prepared on some high and dry situation, by sinking a pit, nearly fifteen feet deep, which is lined with straw, first, and afterward with a second lining of coarse blanketing. The ice is deposited here, and beaten down with hammers, till, at length, its own accumulated and accumulating cold, again freezes the whole mass into a solid cake. The mouth of the store-pit is well secured from the influence of exterior air, with straw and blankets, and lastly, a thatched roof is thrown over the whole.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR APRIL, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	42	58	39	29.74	29.72	29.70	Fair	Fair	Fair	W.	S. W.	W.	
2	32	45	36	29.85	29.94	30.00	Fair	Fair	Fair	N. W.	N. W.	N. W.	
3	36	35	35	29.88	29.62	29.56	Cloudy	Rain	Fair	S. E.	S. E.	N. W.	.52
4	27	42	32	29.82	29.82	29.75	Fair	Fair	Fair	N. W.	N. W.	W.	
5	26	33	28	29.92	30.10	30.20	Fair	Fair	Fair	N. W.	N. W.	N. W.	
6	24	38	28	30.37	30.37	30.40	Fair	Fair	Fair	N. W.	N. W.	E.	
7	26	42	33	30.32	30.27	30.13	Fair	Fair	Fair	S. W.	E.	E.	
8	32	37	28	30.11	30.12	30.19	Fair	Fair	Fair	N. E.	N.	N.	
9	23	32	27	30.20	30.32	30.32	Fair	Fair	Fair	N. W.	E.	S. W.	
10	28	42	38	30.25	30.18	30.12	Fair	Fair	Fair	S. W.	S. W.	S. W.	
11	38	51	38	30.00	30.00	30.01	Rain	Fair	Fair	S. W.	N. W.	S. W.	.19
12	34	65	55	30.00	29.92	29.88	Fair	Fair	Fair	N. E.	S. W.	S. W.	
13	60	71	62	29.84	29.82	29.80	Fair	Fair	Fair	W.	E.	N. E.	
14	38	43	36	29.80	29.80	29.92	Fair	Cloudy	Rain	N. E.	N. E.	N. E.	.04
15	36	40	38	29.98	30.00	30.08	Cloudy	Fair	Fair	N. E.	N. E.	N. E.	
16	35	39	36	30.04	30.08	30.05	Fair	Cloudy	Rain	N. E.	N. E.	N. E.	
17	37	38	38	29.95	29.99	29.99	Rain	Rain	Rain	N. E.	N. E.	N. E.	
18	34	36	34	29.99	30.02	29.99	Rain	Rain	Rain	N. E.	N. E.	N. E.	2.40
19	35	38	33	29.95	29.95	29.90	Rain	Rain	Rain	N. E.	N. E.	N. E.	
20	34	36	34	29.89	29.92	29.93	Cloudy	Rain	Cloudy	N. E.	N. E.	N. E.	.21
21	35	48	46	29.92	29.90	29.84	Fair	Fair	Fair	N. W.	E.	N. W.	
22	40	48	36	29.98	30.05	30.10	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	30	38	32	30.20	30.29	30.15	Fair	Fair	Fair	N. W.	E.	S. W.	
24	36	43	37	30.05	30.10	30.20	Fair	Fair	Fair	N. W.	N. W.	N. W.	
25	36	59	53	30.19	30.05	29.94	Fair	Fair	Fair	S. W.	S. W.	S. W.	
26	56	76	62	29.83	29.72	29.70	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
27	62	74	50	30.73	30.82	30.04	Fair	Fair	Fair	S. W.	N. W.	N. E.	
28	40	42	37	30.15	30.20	30.22	Cloudy	Rain	Fair	N. E.	N. E.	N. E.	.12
29	37	42	40	30.23	30.23	30.21	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.	
30	40	44	42	30.21	30.21	30.15	Rain	Rain	Fair	N. E.	N. E.	N. E.	.46
													3,94

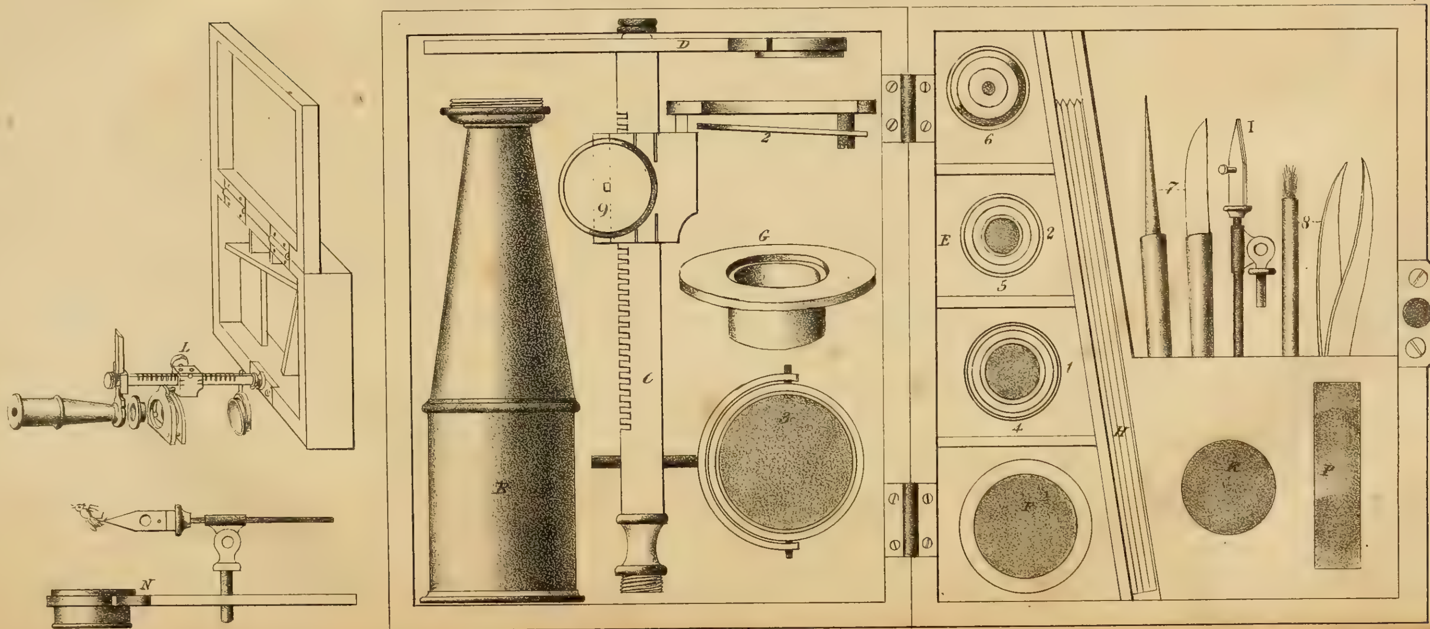
Depth of rain fallen 3.94 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

Gould's Improved Pocket Compound Microscope.

Answering the purpose of the Single, Compound, Opaque & Aquatic Microscope Shuts in a case 3 ins. by 2½ the size of the Drawing with a Magnifying power of 26400 times.

Pl. 7



Pendleton's Lithography, Boston.

THE NATURALIST.

JULY, 1832.

THE MICROSCOPE.

NO. I.

THE microscope, derived from the Greek *mikros*, small, and *skopeo*, to see, is an instrument for viewing minute objects; and it apparently magnifies objects, because they enable us to see them nearer than with the naked eye, without affecting the distinctness of vision. By making a pinhole through a piece of paper, then bringing the eye close to the hole, and the paper within two or three inches of any small object, the object will apparently be much magnified, though without the paper, it would at that distance have been imperceptible.

There are three kinds of microscopes; the single, the compound, and the solar.

Single microscopes, of the greatest power, are very small globules, of glass, which are made by melting the ends of fine threads of glass in the flame of a candle; or by taking a little fine powdered glass on the point of a very small needle, and melting it into a globule. With such microscopes as these, Leuwenhoek made all his wonderful discoveries. The most wonderful single microscopes are those lately made of diamond. The *compound microscope* consists of at least two lenses, by one of which an image is formed within the tube of the microscope; and this image is viewed through the eyeglass, instead of the object itself, as in the single microscope. The microscope being intended only for minute objects, the object lens is consequently of a short focus, and the eyeglass, in this case, is not of so high a magnifying power as in

the telescope. The *solar microscope* is a kind of a camera obscura, which, in a darkened chamber, throws the image on a wall or screen. It consists of two lenses fixed opposite a hole in a board or window-shutter. There is also a plain reflector placed without, moved by a wheel and pinion, which may be so regulated as to throw the sun's rays upon the outer lens. The *lucernal microscope*, invented by Mr. Adams, is also a kind of camera obscura; only the light, in this latter case, proceeds from a lamp instead of from the sun, which renders it convenient to be used at all times.

Nature shows her wonders in the minutest as well as in the largest objects. It is our senses which are not sufficiently acute to perceive the organization of very small bodies, which often escape our observation unless we have recourse to foreign assistance. The microscope has opened to us a new world of insects and vegetables; it has taught us that objects, invisible to the naked eye, exist, having figure, extension, and different parts. Every grain of sand when examined by the eye appears round, but with the help of a glass, we observe each grain differs from the other, both in size and in figure; some of them are perfectly round, others square, some conical, and the major part of an irregular form. What is still more astonishing, by microscopes which magnify objects millions of times their natural size, we can discover, in the grains of sand, a new animal world; for within their cavities, dwell various insects. One of the most wonderful displays in nature is a drop of putrid water, exhibited in a powerful valve microscope, by means of which it covers a space of nine feet in diameter. It is full of living creatures of the strangest shapes, and as their motions are magnified, the rapidity with which they appear to move is perfectly astonishing. In the vegetable kingdom we are presented with a thick forest of trees and plants, bearing leaves, branches, flowers, and fruits; the rudiments of all which beautiful objects, were once hidden beneath the mould. Little as we should expect to find these in such a bed, as little should we have supposed the dust upon the wings of a butterfly to be minute feathers, or the bloom of a peach to be a collection of insects, had not the microscope furnished us with this intelligence.

> 'How sweet to muse upon His skill display'd,
> Infinite skill! in all that he has made;
> To trace in Nature's most minute design
> The signature and stamp of Power Divine;
> Contrivance exquisite express'd with ease,
> Where unassisted sight no beauty sees;
> The shapely limb, and lubricated joint
> Within the small dimensions of a point;

Muscle and nerve miraculously spun,
His mighty work who speaks, and it is done.
Th' invisible in things scarce seen reveal'd;
To whom an atom is an ample field.'

The microscope endows us, as it were, with a new sense: unfolds the amazing operations of Nature, and displays to us wonders unimagined by former ages. Who, a thousand years ago, would have thought it possible to distinguish myriads of living creatures in a single drop of water? That the purple tide of life, and even the globules of the blood, should be seen distinctly, rolling through veins and arteries, smaller than the finest hair? That not only the exterior form, but even the internal structure, and the motion of the fluids in a gnat, should be rendered visible? Or, that numberless species of creatures should be made objects of vision, though so minute, that a million of them are less than a grain of sand? These are noble discoveries, on which a new philosophy has been raised, that enlarges the capacity of the human understanding, and affords more sublime and just ideas than mankind had before, of the infinite power, wisdom, and goodness of the Great Creator.

'The artificial convex will reveal
The forms diminutive that each conceal;
Some so minute, that, to the one extreme,
The mite a large leviathan would seem;
That yet of organs, function's sense partake,
Equal with animals of larger make.

In curious limbs and clothing they surpass
By far the comeliest of the bulky mass.
A world of beauties! that through all their frame
Creation's grandest miracles proclaim.'

It was an observation of the excellent Mr. Boyle, that his wonder dwelt not so much on Nature's clocks as on her watches. And, indeed, if we compare the structure of an elephant with that of a mite, we shall perceive the justness of his remark. With whatever degree of surprise, or even of terror, we may at first consider the huge bulk and prodigious strength of the elephant, we shall find our astonishment still greater, if we attentively examine the minute parts of a mite. The mite has more limbs than the elephant; each of them furnished with veins and arteries, nerves, muscles, tendons, and bones; it has eyes, a mouth, and a proboscis too, as well as the elephant, to take in its nourishment, a heart to propel the circulation of the blood, a brain to supply nerves in every part, and other organs as perfect as in the largest animal. Now, if the extreme minuteness of these parts is not

merely surprising, but far above our utmost conception, what shall we say to those various species of animalcules, to which the mite itself, in size, is as it were an elephant? Inconceivable, as it may appear, it is yet a fact, that a mite upon a cheese is as large and considerable, in proportion, as a man upon the earth. The little insects that feed upon the leaves of peach-trees are no inappropriate representation of oxen grazing in large pastures; and the animalcules in a drop of water swim about with as much freedom as whales do in an ocean. They have all equal room in proportion to their bulk. In each, too, the organization is as perfect as in the others; and the quantity of life and activity seems not in the least diminished, though the parts in which they are seated be so small as to elude our observation.

In pursuing this subject, we shall confine ourselves to the description of Gould's pocket microscope, which we deem the best for scientific purposes, and its application to objects of natural history.

The extreme portability and great magnifying power of this microscope will recommend it strongly to the naturalist, mineralogist, and botanist, as it has sufficient powers to discover the most minute animalcule and seed vessels; it combines the uses of the Single, Compound, Opaque, and Aquatic microscopes; and has been found, upon comparison, by several scientific gentlemen, superior in power, and more distinct than many of the largest and most expensive instruments of the kind;—it shuts up in a case, three inches by three and a half, and may be carried in the pocket without the slightest inconvenience.

DESCRIPTION OF THE PLATE.

A—The microscope, as it lies in its case, the body and pillars taken out, to show the apparatus underneath.

B—The Compound Body.

C—The Pillar on which is fixed the stage—Fig. 2, and reflecting mirror—Fig. 3. These remain on the pillar when put into the case, for the convenience of packing.

D—The Arm may be taken off and used as a hand microscope—Fig. N.

E—The different powers, Nos. 4, 5, 6. These are screwed on to the arm, and in them the body, but each may be used singly for large or opaque objects without the body. Nos. 1 and 2 may be combined; No. 6, being the highest power, is not to be combined with either 4 or 5.

F—The Object-Box, which unscrews to place live objects in, such as mites from cheese; this is placed on the stage.

G—A moveable piece, to place on the stage, Fig. 2, for holding objects.

H—Slides filled with curious objects.

I—A Pair of Steel-Pointed Forceps, which open by pressing the two brass pins, for holding flies, or pieces of card with opaque objects on them; this is placed in the hole on the stage or on the arm, when used as a hand-microscope—Fig. N.

L—The whole instrument put together for use.

N—The Arm converted into a hand microscope.

P—Two Pieces of Glass sealed together for holding a drop of water.

R—A circular Piece of Glass for placing on the stage G to hold any object.

7 and 8—A Dissecting-Knife and Point; a Pair of Brass Forceps, for taking up small objects, with a spoon at the end for taking up a single drop of water, for placing between the two glasses to view the animalcule; a small brush for taking the mites from cheese, farina from flowers, and other delicate objects.

Directions for putting the Microscope together. First take out the pillar, on which is fixed the stage and reflecting mirror; screw it on the brass-piece on the side of the box; turn the mirror to face the light, and move the stage to the centre of the pillar by means of the rack and pinion; place one of the powers on the body, and screw it into the arm: you must now get a clear and distinct field; this you will obtain by moving the mirror to the proper angle to reflect the light, at the same time looking through the microscope: now place the object to be examined on the stage; get the proper focus of the lens, by moving the stage up and down by means of the milled head, fig. 9. To place the slides in the stage, press down with the fingers the brass spring underneath; as an improvement for viewing objects generally, the moveable piece G is placed upon the fixed stage, fig. 2; it may be moved by the finger and thumb, with the greatest delicacy, in any direction; the object to be examined being placed upon the circular piece of glass. To place the pillar again in the case, let the stage be brought close up to the arm, and the mirror turned round; they will then fit into their place without being separated from the pillar. It is more difficult to get the reflected light with the candle than by day-light, but many of the objects appear to much greater advantage; the candle should be placed at the distance of about twelve inches, not too high, and in a straight line with the mirror.

Description and application of the different powers. This microscope has four different powers, so arranged

that objects may be viewed, from the size of a large beetle or moth to the most minute animalcule. These powers are marked Nos. 4, 5, 6; No. 4 is the lowest power, and is calculated for viewing opaque and large objects, and should be used without the body; No. 5 is the next power, and is calculated for viewing all the objects of the size of those in the slides; the next power is produced by combining the Nos. 4 and 5 together, which may be called the third power; it magnifies twenty-five hundred times, and is adapted for viewing the animalcules, &c. The greater power is in a conical cell, marked No. 6; with this power an object is magnified twenty-six thousand times with the body, which is equal to the largest compound microscopes; it should only be used for extreme minute objects, and without either of the other powers: as the object and the lens come extremely near when it is used, care must be taken, by a very delicate movement of the stage, that they do not come in contact with each other in getting the proper focus. To prevent this, if a drop of water is to be examined, place it between the slips of glass, and if these will not admit the lens to come near enough, place a piece of thin talc upon it. Objects should first be viewed with the low powers, that the whole of them may be seen, and the highest ones can then be used in gradation.

Objects for the Microscope. In the summer months, the waters, as well as the hedges, abound with living wonders for the Microscope, and afford an endless amusement to the admirers of the works of nature in the minute creation.

Best Method of procuring Aquatic Insects. In the ponds and ditches that are covered with duck-weed, surprising insects may be found: some of this weed should be procured, and put into a white earthen vessel; it will be a never-failing supply of living, and most entertaining objects for the microscope, and may be kept the whole of the winter months, as the leaves have the valuable property of keeping the water fresh. Every proprietor of a microscope, who would wish to secure a supply of a great variety of interesting living objects in constant readiness, should adopt this method of obtaining them. The decayed leaves will be found best for the purpose; two or three of these being taken out, with a small portion of water, on a piece of glass, gently press them, and the wheel animal, as well as many others, will come out from the cells in which they have taken up their abode. The bell-shaped polype, the proteus, and other smaller kinds of animalcules, may thus be had in great numbers.

Those that are visible to the eye may be easily procured by the aid of a small landing-net made with stout wire and book muslin: bend one end of the wire into a circle and secure it by twisting; the other end will serve for a handle by which it can be attached to a stick; when used, suffer the water to drain away, then reverse the instrument, touching the water (into which the insects are to be transferred) with the muslin, by which means they can be so transferred without injury by handling; a smaller instrument (about one and a half inch diameter) will be found very serviceable, upon the same plan in fishing out the insects; when about to be exhibited, put some clear water in a watch-glass, and reverse the net with the insects into it; any one of them singly may be taken out by means of the small spoon or brush for examination.

Beetles, Moths, *&c.* Numbers of these may be found by attentively examining the hedges in lanes; almost upon every leaf you may discover some minute living creature. On the grass, a great variety of the beetle tribe may be procured, under stone, in old trunks of trees; in the bark among the heaths and mosses, and in sand-pits; and a great variety of wings and other parts of insects may be found on the webs of the field spiders, most beautifully dissected for the microscope, in a way that could not be done by any other means. Insects of the beetle class are found in the greatest abundance upon heath. Mosses and vegetation on old walls, contain many rare and curious microscopic insects; a quantity of this moss should be procured, put into boxes, and afterwards carefully shaken over a sheet of white paper.

Apparatus for collecting objects. These are simply as follows:—A net of wire gauze for taking insects on the wing. It may be held also expanded under a tree or bush, whilst the branches are beaten with a stout stick, which will cause a number of curious insects to fall into it.

A Landing-Net, for aquatic insects.—A Knife, for extracting objects from the root of trees, bark, *&c.*

A Strong Phial, corked, with a quill passing through it, for water insects.

A Tin Box, the cover pierced with small holes.

A few Chip Boxes.

Directions for dissecting objects. In dissecting minute insects, as the flea, louse, *&c.*, in order to examine their internal structure, it is necessary to observe great care: they should be placed in a drop of water and examined instantly, or the parts

will shrink up. A delicate lancet, with a pair of the finest scissors and forceps are generally used for such purposes.

Mehtod of preparing and applying objects for the Microscope. Most objects require a little management, in order to bring them properly before the glasses: if they are flat and transparent, put them between the talc in the slides,—the scales of fishes for instance, *&c.* In making your collection of objects, if you wish to fill a number of slides, care should be taken to arrange them as near the size of each other as possible in the same slider, in order that they may be examined by the same power. Minute living objects, such as mites in cheese, small insects on vegetables, *&c.*, should be delicately brushed off into the object-box, and shut up; flies, small beetles, *&c.*, may be held by the forceps.

To view the circulation of the blood, *&c.* in aquatic insects, place them in a small portion of water on a piece of flat glass; two pieces of glass may be made open enough to receive any sized objects of this kind, similar to the animalcule apparatus.

For viewing animalcules in fluids with the greatest facility. The great difficulty of viewing animalcules in fluids must have been felt by all who use microscopes. A drop of water placed on a piece of glass forms a convex surface, and when a high power is used, the animalcules are continually getting out of the focus by diving to the bottom, and the drop very soon dries up.

The following contrivance effectually removes these obstacles, when the focus of the power in use will admit one of the pieces of glass to intervene between the surface of the lens and the object.—It consists of two pieces of glass fixed with a small portion of sealing-wax between them, and left open at the top. For viewing animalcules, these pieces should be pressed as close together as possible, but for larger insects they may be left more open. If a single drop of water is taken up by the small spoon at the end of the forceps, and spread over the orifice, it will run in between the two glasses, by which means the surface of the water is rendered perfectly even, and the animalcules are distributed more truly, and confined in a more limited space, whereby their forms and movements become more discernible. This plan also prevents evaporation from the surface, which often dims the lens, and perplexes the observer: a single drop of water may be kept for hours in this way, with any curious animalcule alive in it. The glasses can be cleaned out by introducing a piece of thin writing paper between them, and a drop of pure water. By

leaving sufficient room between the glasses, the larger aquatic insects may be viewed; such as small tadpoles, the ephemera, and the water flea. When animalcules and other minute objects are viewed with a lens of short focus, the following contrivance is simple and useful: upon a suitable piece of glass describe a circle with white paint; when dry, place the drop of water within the circle, and cover it with a very thin piece of talc, the space between the talc and glass, produced by the paint, affords sufficient room for the animalcules to move—the talc (if sufficiently thin) offers no obstruction in bringing the object to the focus of the lens.

Slides for transparent and opaque objects. You will find clear slips of glass preferable to talc in forming the slides for transparent objects; they may be prepared in the following manner: take two slips of glass about the size of the ivory slides; then get a piece of writing paper, with holes, of the same size; wet one side of the paper with gum-water, and lay the glass upon it, suffering it to dry; then place your objects in the holes, wet the other side in the same manner, and lay on the other glass: any curious objects may be preserved in this way without danger of their perishing: talc may be applied, as in the preceding article, for deep powers.

Opaque objects. Opaque objects may be prepared for examination in the following way: cut a card or piece of stiff paper the size of the object to be examined; put a little gum-water upon it, and the insect will adhere to it, and may be viewed by placing it under the microscope, on the stage; or by means of the steel forceps it may be held in the hand as in fig. N. For viewing minute opaque objects with a high power, with the body, a strong light must be condensed and thrown down upon them by means of a lens, but the single power or lens is better adapted for that purpose. To preserve curious opaque objects, they may be fixed on some slips of glass with gum-water, and another glass placed over them, cemented together with sealing-wax.

CONCHOLOGY.

NO. V.

Of the formation of the Umbilicus, Protuberances, &c. We have hitherto considered only the general formation of shells. In the present section we shall treat of some other circumstances which produce variations in their external figure. Such, for instance, is the formation of the umbilicus, of spines, tubercles, ribs, and other protuberances.

Umbilicus. Univalve shells, which are furnished with a regular spire, may be divided, with regard to their form, into four classes; namely shells having a disk, cylindrical shells, turbinated, and ovoid or egg-shaped shells. These four terms are the most common, which spiral univalve shells assume, and they depend on the manner in which the turns of the spire are applied to the common axis, and the difference in their arrangement. They derive their primitive figure from the small shell while it is yet included in the egg, and probably from that of the external organs of the animal, which is contained in it. But, although all univalve shells may be referred to one or the other of these four principal forms, they exhibit a great variety of slighter shades of difference. Let us now see in what way it may be conceived that the bodies of the animals which inhabit univalve shells, give them a spiral form. If we can suppose that from the first production of these animals, when they begin to be developed, the fibres of one part of the body, such as those of the external surface, are longer than those of the opposite surface, it is obvious that the body of the animal continuing to increase, according to its original tendency, will assume a curved form, the concave part of which will be on that side where the fibres are shortest, and if the long fibres on the external surface, and the short fibres on the internal surface, continue to increase in the same proportion, this must give the body a spiral form; but in this case, the different convolutions of which the animal is composed, will be in the same plane, and can only apply to a small number of shells included in the first division, namely, those which are characterized with having a disk.

The convolutions of the spire which are described by the shell of univalve testaceous animals, and the body which serves as a mould for these, are disposed in different planes. Some other cause, therefore, must operate in producing this deviation. Between the two surfaces of the body of the animal, which is supposed to be furnished, with fibres of different lengths, it is easy

to conceive two other surfaces directly opposite to each other, an upper and an under surface, each of which is included between the two preceding surfaces, but of smaller extent; and it is easy to conceive farther that these two latter surfaces are so formed, that the fibres of the one are longer than the corresponding and opposite fibres of the other. According to this structure, the body of the animal will tend to that surface on which the fibres are shortest, and thus describe, during its developement, a spiral line in different planes, in proportion to the difference of tension between the superior and inferior surface of the body, as well as between the lateral surfaces.

The form of the shell depending on the external form of the body of the animal, the umbilicus, which is a different cavity from that of the opening of the shell in which the animal is contained, and which is seen on the interior surface of some shells, in the centre of the convolutions of the spire, depends entirely on the plane on which the animal has formed the additions to its shell. If the plane of these convolutions has been directed round a conical or eliptical axis, and each convolution of the spire be more or less distant towards the centre of the shell from this hollow point, a shell may be thus formed, whose umbilicus will be more or less open, according to the greater or less degree of separation which the animal must give to the convolutions of the spire, corresponding to its structure. An opposite effect will be observed, if the increase of the convolutions of the spire is supposed to take place round an axis which is so small as to permit them to come in contact with each other. In this case no cavity will be formed in the centre, no appearance of an umbilicus will be seen. But if we conceive that the animal, in enlaying itself, turns round a solid curved figure, in place of a conic axis above alluded to, and that the end of this solid is at the summit of the shell, it is obvious that an opening or an umbilicus of the shape of this solid, will be formed in the shell.

Ribs. The longitudinal elevations which are observed on univalve shells, which run in a transverse direction to the successive growth of the convolutions of the spire, have been denominated *varices*, by Linnæus, in allusion to the dilated veins on the bodies of other animals. They are composed of one or more elevations, usually arranged in a line parallel to the axis of the shell, and sometimes slightly oblique. They consist of the same substance as that of the rest of the shell, but are thicker and always more elevated than the surface of the convolutions of the spire on which they are placed. To explain the manner in which these convolutions are formed, we may examine the opening of all land shells

when arrived at the last stage of their growth. This period is marked in these shells by a kind of margin of about a line in breadth, which is sometimes turned outwards, although the rest of the shell turns on a regular, spiral line. This reflected margin never appears in land shells, but when they have reached the last period of their growth, and when it is once formed, the animal of some species ceases afterwards to continue the convolutions of its spire. Having now arrived at that period of its growth, when it is fit to perform the act of generation, it protrudes itself more frequently from its shell, and each time it returns, a viscid fluid which exudes from its neck, is interrupted and deposited on the external margin of the shell. The bulk which the anterior parts of the body have acquired in consequence of the evolution of the generative organs, which are contained in that part of the body, causes it to press more strongly than formerly on the edges of the opening of the shell, every time it protrudes itself, and gradually forces the particles of testaceous matter which have been recently deposited to the external surface, and in direction quite different from that of the former plane of the spire. A short time is only requisite for the complete formation of this elevation; but after it has been formed, if the animal has the power of continuing the spire on the former plane, the shells which had arrived at a larger size, will exhibit from time to time, if the same process be repeated, longitudinal projecting ribs, convex or bent, exactly similar to the external swelling of the opening of the shell, and analagous to the *varices* which are seen on some species of marine shells.

This power of continuing the spire, after the formation of the eminence at the opening, is peculiar to sea shells. No farther increase, after it is once formed in land shells takes place. The young of some sea shells, as some species of *murex*, also possess this faculty of continuing the growth of shells after the formation of similar elevations, even from the earliest period of their existence, and long before it can be supposed that the organs of generation are evolved. This no doubt depends on some peculiar structure or organization of the animal; and particularly on those of the anterior parts of the body.

Tubercles. Many shells are furnished with tubercles, which are produced by the same organs as the rest of the shell. The fleshy protuberances which are placed on the external surface of the neck of the animals which inhabit them, serve as a mould, and according as there are more or less of these tubercles, while the animal enlarges the turn of the spire, and increases its shell so much, there is the same number of protuberances in the convolution. These protuberances, while they remain on that part of

the body of the animal on which they were formed, are hollow, and during the remaining part of its existence, as the body enlarges, they are partly hollow, and partly solid, being filled with testaceous matter, excreted from the body of the animal, and then the internal surface of the shell becomes smooth and even.

Spines, and fringed or irregular protuberances, with which some shells are armed, have, according to all appearance, the same origin as the other inequalities on the external surface of shells. They are usually formed at the end of the different successive periods of the growth of the shell. This will be sufficiently obvious, if we trace the whole series of wrinkles or striæ which run parallel to the circumference of the opening. Those which arise immediately from the ribs or *varices*, are produced by particular organs which surround the extremity of the neck, and stretch out from every part of its circumference, secreting a testaceous matter, which partly forms a sheath around them, gradually increases in thickness, and successively assumes the form of that part of the body which in some measure serves the purpose of a mould. In all the species of murex, which are furnished with spines, the elevation called the varices, or ribs as well as the spines with which they are armed, are placed on the shell at equal distances, and the intermediate parts of the shell, although frequently grooved or striæted, are not furnished with spines.

This uniform observation, not only in shells belonging to this genus, but also in almost all spinous shells, proves, that the spines as well as the ribs, are to be considered as formed by the margin of the anterior parts of the body, which is renewed in the same proportion as the change in the position of this part of the body takes place. It proves also, that the formation of shells is entirely owing to the successive and regular enlargement of the animal; and that it increases every time it is displaced from the whole extent in breadth of the anterior part of the body, the margin of which, only being furnished with long, fleshy processes or fringed appendices, is in reality the only part which produces them on the shell at each period of its increase. In the same way is formed the beak or prolongation of the shell, which terminates the inferior extremity in the form of a canal. This canal is produced in all shells in which it exists, by a cylindrical organ, susceptible of extension and contraction, and which, according to some naturalists, is employed by the animal as a kind of feeler, and occasionally to attach itself to solid bodies. It excretes and deposits a testaceous layer which serves it as a kind of sheath, in a similar manner to the production of spines.

It is easy to explain the formation of the grooves or elevated

ribs which are found on the outer surface of other shells; while the whole of the internal surface is smooth and polished. In bivalve shells, which exhibit this structure, the whole anterior surface of the animal is grooved or channelled in the same way; and from this, the shell derives its shape and structure. In these shells it may be observed, that it is only the anterior margin that is grooved on the internal surface; because in the progress of the growth of the animal, that part of the body which presents a smooth, equal surface has advanced, and nearly filled the whole of the shell; and the testaceous matter secreted from this part of the body being deposited on the grooves, channels, or striæ, which were formed when the anterior part of the body occupied that part of the shell, fills them up completely, and leaves the surface quite smooth and polished. New additions being made to the shell as the growth of the animal requires it, the smooth surface of the body advances forward, and fills up with secretions what is now grooved; while the new part of the shell which corresponds to that part of the body which has an unequal surface, only presents this appearance. It is in this way that the ribs or grooves are formed in different species of ostrea, cardium, and other bivalve shells.

But there is a peculiarity of structure in a species of cockle, the white fluted or ribbed cockle, *Cardium costatum*, which seems more difficult of explanation in its mode of formation.

The ribs of this species are not only of the usual structure of other species of ribbed or grooved shells, but are particularly distinguished by having them hollow. The whole number of the ribs amounts to about eighteen on each valve, of which the eleven exterior ones are of a triangular form; of about three lines high, and hollowed through their whole length, from the beak to the margin of the valves. To have a distinct notion of the formation of these hollow, triangular ribs, it is necessary to conceive, that the margin of the anterior parts of the animal, is deeply channelled or grooved; and when this part is in contact with the recent shell, the ribs or elevations are formed, and are then open to the internal surface of the shell; but the posterior part of the body being hard and smooth, never comes in contact with the excavated part of the ribs. On the contrary, as the testaceous matter is excreted from this part of the body, it is deposited on that part of the internal surface of the shell which it touches, stretches across the deep grooves, and forms the third and interior side of the triangular ribs. Thus it appears, that spines, tubercles, and all other protuberances on the surface of bivalve shells, owe the peculiarity of their form and shape to the peculiar structure of dif-

ferent organs situated on the anterior margin of the body of the animal, and composed of the testaceous matter which is excreted by these organs.

The nature of the process is the same as in univalve shells of a spiral form. The diversity only appears in the difference of the organs, and structure of the animals which inhabit different shells. To a similar process may be ascribed the formation of striæ, of scales, and of various excavations which sometimes accompany them.

ORNITHOLOGY.

NO. VII.

Pulverizing of Birds. Among the singularity of manners, perhaps there is none more extraordinary than that which seems peculiar to a few species; by some, called *pulverizing*, which is that of dusting themselves; it is observable only in the gallinaceous tribe; the sky lark, wood lark and house sparrow. These are frequently seen in hot weather to roll themselves in the dust, and by means of their wings and legs, throw it all over their bodies. For what purpose it is intended, is difficult to ascertain. Some have imagined it is to destroy the *pediculi* with which these birds abound; but as all other birds are troubled with lice, and do not pulverize, the opinion does not seem to be well founded. Others have supposed that it is to cool themselves, and, that such birds do not wash; but in this also they are mistaken, for no bird *bathes more* frequently than the sparrow.

Walk of Birds. All aquatic birds and waders walk or run in the ordinary manner, placing one leg before the other alternately; but a greater portion of the smaller land birds hop or rather jump along, as if their legs were tied together.

Swimming of Birds. The superior velocity with which aquatic birds swim under water, has not wholly escaped notice; but it is not entirely produced by the action of the wings, which are sometimes used as fins to accelerate the motion, but is occasioned by the pressure of the water above. In swimming on the surface, a bird has two motions; one upward, the other forward at every stroke of the feet; so, that when covered with water, that force which was lost by the upward motion, is all directed to the progressive, by which it is enabled to pursue its prey, or to

escape an enemy with incredible speed. The otter and water rat swim much faster under water, than they do upon the surface.

Sleep of Birds. Like horses and some other quadrupeds, a great number of birds sleep standing; the perchers, for example, usually sleep standing on one leg upon some tree, brush or other elevation, with the head turned behind, and the bill thrust under the feathers on the back, or under the wing. Indeed these appear to be the general habits of the whole race of birds, in regard to their mode of resting and sleep; for the duck and goose, although they do not perch, will frequently sleep standing on one leg upon the ground, with their heads turned round, and their bills under their wing. Poultry, although they invariably perch, if a perch can be obtained, do not, when sleeping, rest usually on one leg; but they sink down with their bodies upon the perch, having their legs compressed under them. The sky lark sleeps upon the ground with his legs also similarly compressed. It is probable also that all the tribes of birds, even the perchers, occasionally sink down with their bodies resting on the perch during their soundest sleep. What is very remarkable in the structure of their feet and legs, is, that the greater the weight upon the muscles, the more firmly the claws grasp whatever they lay hold of; hence the cause that birds do not fall down in sleep, although most of their senses are dormant.

The motion of the branches of trees, produced by the wind, increases, doubtless, the disposition for sleep in many birds; this may be exemplified by the common fowl: for placing its bill under the wing, even in broad day light, and swaying it to and fro in the hand for a very short time, will produce sleep. Most of the tribes of birds sleep during the night; but there are many exceptions to this. Owls in particular, are, during the night, much more active than in the day; their sight, similar to that of cats, appears to serve them best in the dark. Many of the duck tribe are not only wakeful, but feed during the night. The nightingale and whip-poor-will are also wakeful while in song, during a considerable portion of the night.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. VII.

Diseases of Silkworms. 'The silkworm is said to be subject to many diseases. There is reason for believing that most, or all of these, are either the consequences of bad treatment, or are easily counteracted by simple remedies. Count Dandolo, to whose recorded experience reference has so often been made in these pages, was obliged to have recourse to other cultivators for the means of describing diseases that did not exist in his own establishment.

' The custom which prevails in Italy and France, of distributing silkworms to be reared in the dwellings of the peasantry, has confined the management principally to the hands of ignorance and prejudice; and little or no improvement had in consequence been made in this part of rural economy, until count Dandolo devoted himself to its reformation, and thereby promoted a branch of industry highly important to the prosperity of his native country. This nobleman pursued the occupation with patriotic and philosophic aims far different from such as usually characterize pursuits of business. He brought scientific knowledge and enlightened views to the subject, and afforded a clear exemplification of the fact, that there is no process, however simple, no employments, however humble, and which might apparently be consigned without injury to the hands of the untaught and unreflecting, that do not call for the head, as well as the hand of man, to conduct them on rational principles, and to derive from them all the beneficial results they may be made capable of yielding. It is seldom that objects of profit are thus undertaken and pursued. It most generally happens, that toils of this nature are assumed from necessity, by persons who think only of rendering them subservient to the calls of that necessity; who have neither mind nor leisure for experiments; and who, if, by departing from the beaten track, they have made a greater proficiency than their rivals, are too prone to keep secret their discoveries with a view to individual advantage. Count Dandolo was not thus satisfied to find out and to pursue the most advantageous methods, but widely disseminated the knowledge of his mode of treatment, not only by his writings, but by inviting the great proprietors, his countrymen, to send pupils to him, who might obtain practical instruction in his methods. These pupils sometimes occasioned great losses to

him, as in order to their acquiring the necessary degree of skill, they were sometimes allowed to act upon their own suggestions. " But this signifies little," he would say, " compared to the advantage of diffusing and naturalising the improved art of rearing silkworms by means of these pupils." Shortly after the publication of his treatise, large establishments were formed in Lombardy, according to his recommendation: these were called *Dandolières*, as a testimony of respect for his disinterested philanthropy.

' The causes which principally engender diseases in the silkworm, appear to exist in either damp, stagnate, or mephitic air. Some experiments, tried in order to ascertain the fact, show, that damp air is even more prejudicial to them, than mephitic (carbonic acid) gas. If a silkworm be introduced into a receiver charged with carbonic acid gas, and in which a bird would instantly die, although the worm quickly exhibits signs of uneasiness and suffering, it will live for ten, fifteen, or perhaps twenty minutes: no warm-blooded animal could continue alive in such an atmosphere for half that time. If, after remaining a few minutes, the worm be withdrawn from the receiver, it will not exhibit any sign of injury, but will be, apparently, as healthy as before inhaling this pernicious gas. The silkworm appears endued with the power to seize upon the minutest portion of vital air which may be held by water, as it will live for some minutes immersed in this fluid, particularly in its first ages; and, even when seemingly dead, it will revive if taken out. It would seem, however, that when its power of breathing is obstructed, the worm instantly dies: if, instead of plunging it in carbonic acid gas, or in water, its eighteen breathing holes are sealed up with grease, it expires instantaneously.

' If a healthy silkworm be confined in a vessel, the air in which, is charged with moisture, and heated to the temperature of 88° or 90°, it will very soon exhibit symptoms of indisposition, and reject food; the skin will slacken, the muscles soften, and contraction cease. In a short time evaporation will be obstructed, the secretions indespensable to vitality, which are effected in this animal by means of contraction,* will be suspended, and ere long it will perish. A warm-blooded animal, on the contrary, if sufficiently supplied with pure air, can live without any suffering, and perform all its functions without inconvenience, in such a temperature, whatever be the attendant degree of moisture. This proves how different is the structure of these two classes of animals.

* The skin of the silkworm has so great a power of contraction, that on being cut through it shrinks in the manner of an elastic substance that has been drawn out.

'In the southern departments of France, it is very common to see silkworms attacked by a disease, which, in consequence of the color assumed by them, is called the jaundice. Very careful examination is continually made for the discovery and removal of worms which may be thus attacked, lest the disease, which is contagious, should spread to others. It is stated in the Bulletin Universel, that the abbè Eperic of Carpentras had recourse in this case to a remedy, or rather a preventive, which, though apparently dangerous, has been justified by the uniform success of twenty years. By means of a fine silk sieve he powdered his worms with quicklime, and after this gave them mulberry leaves moistened with a few drops of wine; these, the insects instantly commenced devouring with an eagerness greater than that which they usually exhibited, and not one of the hurdles, upon which the worms were thus treated, ever appeared infected with jaundice. It was at first supposed, that the cocoons might be injured by this process; but this is not the case, and the method is now very frequently adopted in the department of Vaucluse.

'It is well known, that decayed leaves emit mephitic air abundantly, and the lime may have been efficacious in absorbing and fixing this as it was generated, leaving the atmosphere inhaled by the insects in a desirable state of purity.

'Mons. Blanchard records the following experiment, which satisfactorily proves the efficacy of the use of lime:—"I procured," he said, "four glass jars, nine inches deep, and five in diameter, and provided them with cork stoppers. In each of these glasses I placed twelve silkworms at their second age; these were fed four times a day, and I confined them in this kind of prison all their lives, without taking away either their dead companions or their litter. I sprinkled with lime the worms of only two of these jars, and kept the two others to compare with them. In those without lime, I never obtained more, or less than three, small and imperfect cocoons, and in the two that were sprinkled with lime I had very often twelve, and never less than nine fine full-sized firm cocoons." Mons. Blanchard ascertained, by many trials, that the worms were not incommoded when covered with a large portion of lime.

'Count Dandolo advises fumigation with chlorine gas; but the mode of producing this from black oxide of manganese, common salt, and sulphuric acid, might be attended with unpleasant consequences, if intrusted to ignorant or careless hands, and to inhale the vapor, as generated, is not only unpleasant but dangerous. Chloride of lime, the use of which, is attended with highly beneficial results, as a disinfectant, and in neutralising the pernicious ef-

fects of mephitic vapors, might prove advantageous in silkworm establishments, producing all the good effects of fumigation with chlorine gas, without hazarding any of the pernicious results which might accompany the latter application.

'Among the peasants of France and Italy, there is a practice of fumigating the room where the insects are kept, with some kind of aromatic gum or odoriferous plant, but these only serve to conceal without correcting the effluvia, which should warn the attendants of the necessity for cleanliness, and instead of removing, increase the evil.

'An almost incredible quantity of fluid is constantly disengaged by evaporation from the bodies of the insects; and if means be not taken to disperse this as it is produced, another cause of unwholesomeness in the air arises. Noticing this, count Dandolo observes, "This series of causes of the deterioration of the air which the worms must inhale, may be termed a continued conspiracy against their health and life; and their resisting it, and living through it, shows them to have great strength of constitution."

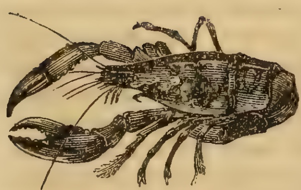
'Before this nobleman so zealously undertook the work of reform, the poor silkworms had to struggle through a miserable existence, until, their numbers thinned by death, and their frames weakened by disease, they feebly began to spin that thread, which would have been produced superior in quality and much greater in quantity, had they been more judiciously tended. By his methodical arrangements, the accidents of seasons and external temperature are no longer formidable. In 1814, a year peculiarly unfavorable for rearing these insects, and which proved extensively fatal in other establishments, he continued his operations with the same unvaried regularity, and, with perhaps increased precautions, was ultimately rewarded by the usual success.

'In noticing the system already mentioned of distributing silkworms among the dwellings of the peasantry, count Dandolo gives the following distressing picture:—"In general the rooms appropriated to rearing silkworms among the tenants, farmers, and common cultivators, have the appearance of catacombs; I say in general, for there are some few who, although they may not have all the requisites for rearing worms in perfection, yet have care sufficient to preserve them from any very serious disease.

'I have found, on entering the rooms in which these insects were reared, that they were damp, ill lighted by lamps fed with rancid oil; the air corrupt and stagnant to a degree that impeded respiration; disagreeable effluvia disguised with aromatics; the wickers too close together, covered with fermenting litter upon which the silkworms were pining. The air was never renewed,

except by the breaches which time had worn in the doors and windows; and what made this more sad and deplorable, was the knowledge that the persons who attended to these insects, however healthy they might have been, when they entered upon the employment, lost their health, their voices became hollow, their hues pallid, and they had the appearance of valetudinarians, as if issuing from the very tombs, or recovering from some dreadful illness."

THE LOBSTER.



'WITH all the voracious appetites of fishes, the lobster is condemned to lead an insect life at the bottom of the water; and though pressed by continual hunger, they are often obliged to wait till accident brings them their prey. Though without any warmth in their bodies, or even red blood circulating through their veins, they are animals wonderfully voracious. Whatever they seize upon, that has life, is sure to perish, though ever so well defended: they even devour each other; and, to increase our surprise still more, they may, in some measure, be said to eat themselves; as they change their shell and their stomach every year, and their old stomach is generally the first morsel that serves to glut the new.

'The lobster is an animal of so extraordinary a form, that those who first see it are apt to mistake the head for the tail; but it is soon discovered that the animal moves with its claws foremost; and that the part which plays within itself by joints, like a coat of armour, is the tail. The mouth, like that of insects, opens the long way of the body, not crossways, as with man, and the higher race of animals. It is furnished with two teeth in the mouth, for the comminution of its food; but as these are not sufficient, it has three more in the stomach; one on each side, and the other below. Between the two teeth there is a fleshy substance, in the shape of a tongue. The intestines consist of one long bowel, which reaches from the mouth to the vent; but what this animal differs in from all others, is, that the spinal marrow is in the breast bone. It is furnished with two long feelers or horns, that issue on each side of the head, that seem to correct the dimness of the sight, and apprize the animal of its danger, or of its prey. The tail, or that jointed instrument at the other end,

is the grand instrument of motion; and with this it can raise itself in the water. Under this we usually see lodged the spawn in great abundance; every pea adhering to the next by a very fine filament, which is scarcely perceivable.

'When the young lobsters are produced, they immediately seek for refuge in the smallest clefts of rocks, and in such like crevices at the bottom of the sea, where the entrance is but small, and the opening can be easily defended. There, without seeming to take any food, they grow larger in a few weeks time, from the mere accidental substances which the water washes to their retreats. By this time also they acquire a hard, firm shell, which furnishes them with both offensive, and defensive armour. They then begin to issue from their fortresses, and boldly creep along the bottom, in hopes of meeting with diminutive plunder. The spawn of fish, the smaller animals of their own kind, but chiefly the worms that keep at the bottom of the sea, supply them with plenty. They keep in this manner close among the rocks, busily employed in scratching up the sand with their claws for worms, or surprising such heedless animals as fall within their grasp: thus they have little to apprehend, except from each other; for in them, as among fishes, the large are the most formidable of all enemies to the small.

'But this life of abundance and security is soon to have a most dangerous interruption; for the body of the lobster still continuing to increase, while its shell remains unalterably the same, the animal becomes too large for its habitation, and imprisoned within the crust that has naturally gathered round it, there comes on a necessity of getting free. The young of this kind, therefore, that grow faster, as we are assured by the fishermen, change their shell oftener than the old who come to their full growth, and who remain in the same shell often for two years together. In general, however, all these animals change their shell once a year; and this is not only a most painful operation, but also subjects them to every danger. Just before casting its shell, it throws itself upon its back, strikes its claws upon each other, and every limb seems to tremble; its feelers are agitated, and the whole body is in violent motion: it then swells itself in an unusual manner, and at last the shell is seen beginning to divide at its junctures. It also seems turned inside out; and its stomach comes away with its shell. After this, by the same operation, it disengages itself of the claws, which burst at the joints; the animal, with a tremulous motion, casting them off as a man would kick off a boot that was too big for him.

'Thus, in a short time, this wonderful creature finds itself at

liberty; but in such a weak and enfeebled state,that it continues for several hours motionless. Indeed, so violent and painful is the operation, that many of them die under it; and those which survive are in such a weakly state for some time, that they neither take food nor venture from their retreats. Immediately after this change, they have not only the softness, but the timidity of a worm. Every animal of the deep is then a powerful enemy, which they can neither escape nor oppose; and this, in fact, is the time when the dogfish, the cod, and the ray, devour them by hundreds. But this state of defenceless imbecility continues for a very short time: the animal, in less than two days, is seen to have the skin that covered its body grown almost as hard as before; its appetite is seen to increase; and, strange to behold! the first object that tempts its gluttony, is its own stomach, which it so lately was disengaged from. This it devours with great eagerness; and, some time after, eats even its former shell. In about forty-eight hours, in proportion to the animal's health and strength, the new shell is perfectly formed, and as hard as that which was but just thrown aside.

'When the lobster is completely equipped in its new shell, it then appears how much it has grown in the space of a very few days; the dimensions of the old shell being compared with those of the new, it will be found that the creature is increased above a third in its size; and, like a boy that has outgrown his clothes, it seems wonderful how the deserted shell was able to contain so great an animal as entirely fills up the new.

'The creature thus furnished, not only with a complete covering, but also a greater share of strength and courage, ventures more boldly among the animals at the bottom; and not a week passes that in its combats it does not suffer some mutilation. A joint, or even a whole claw, is sometimes snapped off in these encounters. At certain seasons of the year, these animals never meet each other without an engagement. In these, to come off with the loss of a leg, or even a claw, is considered as no great calamity; the victor carries off the spoil to feast upon at his leisure, while the other retires from the defeat to wait for a thorough repair. This repair is not long in procuring. From the place where the joint of the claw was cut away, is seen, in a most surprising manner to burgeon out the beginning of a new claw. This, if observed at first, is small and tender, but grows, in the space of three weeks, to be almost as large and as powerful as the old one. We say almost as large, for it never arrives to the full size; and this is the reason we generally find the claws of the lobsters of unequal magnitude.

'Of this extraordinary, yet well known animal, there are

many varieties, with some differences in the claws, but little in the habits or conformation. It is found above three feet long; and, if we may admit the shrimp and the prawn into the class, though unfurnished with claws, it is seen not above an inch. These all live in the water, and can bear its absence for but a few hours. The shell is black when taken out of the water, but turns red by boiling. The most common way of taking the lobster is in a basket, or pot, as the fishermen call it, made of wicker work, in which they put the bait, and then throw it to the bottom of the sea, in six or ten fathom water. The lobsters creep into this for the sake of the bait, but are not able to get out again. The river crawfish differs little from the lobster, but that the one will live only in fresh water, and the other will thrive only in the sea.'

Buffon's Natural History.

THE WHITE OAK.

Quercus alba.

Fig. 1 A leaf. Fig. 2. The fruit.

THROUGHOUT the United States and Canada, this tree is known by the name of *White Oak.* The environs of a small town of *Trois Rivieres* in Canada, latitude 46° 20′, and the lower part of the river Kennebeck, in the state of Maine, are the most northern points at which this tree grows. Thence, we trace it along the sea shore to a distance beyond Cape Canaveral, latitude 28 degrees, and westward from the ocean to Illinois, an extent of more than twelve hundred miles from north-east to south-west. It is, however, by no means equally diffused over this vast tract; in the state of Maine, Vermont and Lower Canada, it is little multiplied, and its vegetation

is repressed by the severity of the winter. In the lower part of the Southern States, in the Floridas and Lower Louisiana, it is found only on the borders of the swamps with a few other trees, which, likewise, shun a dry and barren soil. The white oak is observed also to be uncommon on lands of extraordinary fertility, like those of Kentucky and Tennessee, and of all the spacious valleys watered by the western rivers. It abounds chiefly in the Middle States, particularly in that part of Pennsylvania and Virginia which lie between the Alleghanies and the Ohio, a distance of about one hundred and fifty miles, where nine-tenths of the forests are frequently composed of these trees, whose healthful appearance evinces the favorable nature of the soil. East of the mountains, this tree is found in every exposure, and in every soil which is not extremely dry or subject to long inundations; but the largest stocks grow in humid places. In the western districts, where it composes entire forests, the face of the country is undulated, and the yellow soil, consisting partly of clay with calcareous stones, yields abundant crops of wheat.

The white oak attains the elevation of seventy or eighty feet with a diameter of six or seven feet; but its proportions vary with the soil and climate. The leaves are regularly and obliquely divided into oblong, rounded lobes, destitute of points: the sections are deepest in the most humid soils. Soon after their unfolding, they are reddish above, and white and downy beneath; when fully grown, they are smooth and of a light green on the upper surface and glaucous beneath. In autumn they change to a bright violet color, and form an agreeable contrast with the surrounding foliage which has not yet suffered by the frost. This is the only oak on which a few of the dried leaves persist till the circulation is renewed in the spring. By this peculiarity and by the whiteness of the bark, from which it derives its name, it is easily distinguishable in the winter. This tree puts forth flowers in May, which are succeeded by acorns of an oval form, large, very sweet, contained in rough, shallow, grayish cups, and borne singly or in pairs, by peduncles eight or ten lines in length, attached as in all species of annual fructification, to the shoots of the season. The fruit of the white oak is rarely abundant, and frequently for several years in succession a few handfuls of acorns could hardly be collected in a large forest where the tree is multiplied. Some stocks produce acorns of a deep blue color.

The bark of the trunk of the white oak is often variegated with large, black spots. On stocks of less than sixteen inches in diameter the epidermis is divided into squares; on old trees, growing in moist grounds, it is in the form of plates laterally attached.

The wood is reddish, and very similar to that of the European oak, though lighter and less compact: in the American species the vessels which occupy the intervals of the concentric circles are visibly less replete. But of all the American oaks, this is the best and the most generally used, being strong, durable, and of large dimensions. It is less employed than formerly in building, only because it is scarcer and more costly. The excellent properties of this wood cause it to be preferred for a great variety of uses, among which are many articles manufactured by the wheelwrights. White oak perfectly seasoned is employed for the frames of coaches, waggons and sledges, for the mould boards of ploughs, the felloes, spokes and naves of wheels. The wood of the young stocks is very elastic and is susceptible of minute division, hence it is preferred for large baskets used in harvesting, for the hoops of seives, the bottoms of riddles and the handles of coach whips; for pail handles and axe helves. In many parts of the Middle States, the white oak is selected for the posts of rural fence. The bark is considered by many tanners as the best for preparing leather for saddles and other similar objects; it is little employed, however, because the bark of the trunk and large limbs only is employed, and on these the cellular integument is much thinner in the white, than in the red and black oaks. The white oak furnishes staves of the best quality, of which are made casks for wine and spirituous liquors. The domestic consumption for this purpose is immense, and vast quantities are exported to the West Indies, Great Britain, and the islands of Madeira and Teneriffe. The young stocks are very elastic and are used for hoops. Among the uses of this wood, the most important is in ship building. In all the dock yards of the Northern and Middle States, except Maine, it is almost exclusively employed for the keel and always for the lower part of the frame and the sides: it is preferred for the knees when sticks of a proper form can be found. In the smaller ports south of New York, the upper part of the frame is also made of white oak; but such vessels are less esteemed than those constructed of more durable wood. The medicinal properties of oak bark depend on its astringency, and that again on its tannin. The inner bark of the small branches is the strongest, the middle bark next, and the outer bark is almost useless. Internally it may be given in form of decoction, of infusion, or powder, as a tonic and astringent in leucorrhœa, menorrhagia, etc., and also in intermittents. Externally, as a styptic, astringent, and antiseptic, when sprinkled in form of a powder over gangrenous, and ichorous ulcers. Inhaled in the form of impalpable powder it has been known to cure phthisic, even in its advanced stages. *Sylva Americana.*

ON VOLCANOES.

Caloric, another cause of combustion, whether it be a substance too fine for being found alone, or a mere phenomenon of other bodies, is the grand agent which counteracts the law of gravitation, and enables the motions and functions of life to be carried on. Whatever is melted is melted by fire ; and whatever is kept in that state, is so kept by the same. Caloric and ice form water; the component parts of water, with more caloric, becomes oxygen and hydrogen gases; and if these be brought together in the proper proportions and a body applied that can cause them to part with their caloric, water is the result; and by the further abstraction of caloric, that water may be changed to ice. There are powers in natural substances, by which caloric may be made sensible without human aid, and the most remarkable of these are volcanoes. The consideration of those phenomena of nature called volcanoes, of which we have instances in the mountains Ætna and Vesuvius, is very interesting. From these, at different intervals, issue terrible eruptions of fiery matter. Sometimes only a black vapor is seen to arise, and at the same time are heard hollow rumbling noises, often succeeded by strong flashes of fire, and peals like thunder, accompanied with the sensation of an earthquake. The vapor then becomes luminous, and showers of stones and lava are evolved, part of which fall again within the crater, though enough fall without to lay waste the neighboring country, and are sometimes whirled to a considerable distance. These terrible explosions are sometimes even more violent. With the noise of thunder, torrents of burning sulphur, and liquid metals, enveloped with clouds of ashes and smoke, are hurled to an immense distance. Rocks upborne by the force of the explosion, fall with a dreadful crash; and cataracts of fire pour down the steep of the mountain; the deluge pours over villages, plantations, and cities; the earth rocks, and they who escape the flood, fall within the gulf made by the earthquake, or, tossed from wave to wave, are buried in the general wreck.

A volcano, or burning mountain, is a wonderful phenomenon. The crater, that is, orifice or mouth of a volcano, in some cases, is more than a mile across; and from this mouth are emitted torrents of smoke and flame; rivers of bitumen, sulphur, and melted metal, the mixture bearing the name of lava; it ejects clouds of cinders and stones, and sometimes enormous rocks, to many leagues distant, when merely to stir them would baffle the utmost efforts of human strength. The combustion is so terrible, and

the quantity of burnt, melted, calcined, and vitrified materials which is thrown out at the orifice is so plentiful, that they enter towns and forests, cover the fields to more than a hundred feet in thickness, and sometimes form hills and mountains. The action of this fire is so great, and the force of explosion so violent, that its re-action has been known to shake the earth, agitate the sea, overthrow mountains, and raze the most solid edifices and towns, even to very considerable distances. In Europe there are three celebrated volcanoes, namely, mount Ætna in Sicily, mount Hecla in Iceland, and mount Vesuvius in Italy, near Naples. Ætna is unquestionably the most ancient on record; but as no mention is made of its burning or eruption by Homer, who flourished about 960 years before Christ, it is reasonable to suppose that a phenomenon at once so tremendous and extraordinary, did not take place before his time. Pindar, who lived 480 years after Homer, is the first poet who has given us a description of its fiery eruptions. He has feigned the giant Typhœus to be overthrown by Jupiter, and overwhelmed by Ætna, whose agitations and eruptions were caused by his vain attempts to release himself from its incumbent pressure. Of this fiction Mr. West has given the following translation:

Now under sulphurous Cuma's sea-bound coast,
   And vast Silicia, lies his shaggy breast;
By snowy Ætna, nurse of endless frost,
   The pillar'd prop of heav'n, for ever press'd;

Forth from whose nitrous caverns issuing rise
   Pure liquid fountains of tempestuous fire,
And veil in ruddy mists the noon-day skies,
   While wrapt in smoke the eddying flames aspire.
Or, gleaming through the night with hideous roar,
Far o'er the redd'ning main huge rocky fragments pour.

But he, Vulcanian monster, to the clouds
   The fiercest, hottest inundations throws,
While, with the burden of incumbent woods,
   And Ætna's gloomy cliffs, o'erwhelm'd he glows.

There on his flinty bed outstretch'd he lies,
   Whose pointed rock his tossing carcass wounds:
There with dismay he strikes beholding eyes,
   Or frights the distant ear with horrid sounds.

Whole chains of volcanic mountains are found upon some places of the earth's surface; and there are, in many other places, traces of volcanoes that have become extinct. There seems to be some connexion between volcanoes and the presence of water,

as the extinguished ones are in places that have become dry; and those that are in a state of activity are never far from the sea. The great quantity of caloric that is given out when the component parts of water are condensed into that liquid is probably the cause, or at least one of the causes.

Besides the astonishing explosion of flames and smoke, of cinders and burning rocks, the eruptions of volcanoes exhibit a dreadful phenomenon, in prodigious inundations of liquid fire, which bear inevitable destruction with them. The Italians give the name of *lava* to these fiery streams. This lava consists of a mixture of stones, sand, earth, metallic substances, salt, *&*c., calcined, rendered fusible, and vitrified by the fire of the volcanoes; but as the mass of which it originally consists, is very heterogeneous, the lava, when cold, appears under various forms and colors. The purest sort is a hard, black, homogeneous, compact glass, and is very abundant in the volcanic parts of Iceland, formed probably of sand and the alkali of sea weed in the bed of the ocean. There is another species which is hard, heavy, and compact, like marble; susceptible of a very fine polish, and converted, at Naples, to a variety of domestic uses. There is another kind, which is a grosser stone, commonly ash-colored, and used both for building, and for paving the streets. That which is found on the surface is still more gross and spongy, resembling the recrements of melted metals. The violent eruption of Vesuvius, in 1767, is reckoned the 27th since that which destroyed the cities of Herculaneum and Pompeii, in the reign of the emperor Titus; and this eruption of 1767, has been succeeded by nine others. Of the eruptions of Ætna, Mr. Holdenburg has given an historical account in the *Philosophical Transactions*, No. xlviii. p. 97. A very great eruption of this mountain took place in the year 1669. The progress of the lava, or fiery deluge above described, was at the rate of a furlong a day. It advanced into the sea 600 yards, and was then a mile in breadth. It had destroyed, in forty days, the habitations of 27,000 persons; and of 20,000 inhabitants of the city of Catania, only 3,000 escaped. This inundation of liquid fire, in its progress, met with a lake four miles in compass, and not only filled it up, although it was four fathoms deep, but raised it into a mountain. Borelli, an ingenious Neapolitan, has calculated, that the matter discharged at this eruption was sufficient to fill a space of 93,838,750 cubit paces. The lava which ran from it, is fourteen miles in length, and in many parts, six in breadth. A mixture of sulphur, filings of iron, and of water, buried at a certain depth below the earth's surface, will exhibit, in miniature, all the appearances of a volcano.

AMERICAN LARCH.

Larix americana.

Fig. 1. A Branch with leaves and cones

In the north of the United States this tree is commonly designated by the name of *Hackmatack*, but we have preferred that of *American Larch*, which is not unknown where the other is habitually used. The French Canadians call it *Epinette rouge*. This tree is most abundant in Vermont, New Hampshire and the state of Maine; but though the soil is well adapted to its growth, and the winter is long and severe, it does not form a hundredth part of the resinous growth, which consists principally of the black and the hemlock spruce and the red cedar. It grows in the Canadas, and extends as far north as Lake St. John; here it begins to abound, and to form masses of woods, some of which are several miles in extent. It is profusely multiplied also in Newfoundland, New Jersey, Pennsylvania and the coldest and most gloomy exposures in the mountainous tracts of Virginia, which are the limits of its appearance towards the south: but it is rare in these states, and in lower Jersey it is seen only in the swamps of white cedar, with which it is scantily mingled. In Vermont, New Hampshire and Maine it grows only in low and moist places, and never on uplands, as about Hudson's Bay and in Newfoundland; hence we may conclude that the climate of the northern part of the United States is too mild for its constitution.

The American larch is a magnificent vegetable with a straight, slender trunk eighty or a hundred feet in height and two or three feet in diameter. Its numerous branches, except near the summit, are horizontal or declining. The bark is smooth and polished on the trunk and lower limbs, and rugged on the lower branches. The leaves are flexible, and collected in bunches: they are shed in the fall and renewed in the spring. The flowers like those of the pines,

are separate upon the same tree: the male aments, which appear before the leaves, are small, oblong and scaly, with two yellow anthers under each scale: the female flowers are also disposed in aments, and are composed of floral leaves covering two ovaries, which, in process of time, become small, erect, scaly cones three or four lines long. At the base of each scale lie two minute winged seeds. On some stocks, the cones are violet-colored in the spring instead of green; but this is an accidental variation, for the trees are in no other respect peculiar.

The wood of the American larch is superior to any species of pine or spruce: it is exceedingly strong and singularly durable. In Canada it is considered as the most valuable timber, and has no fault except its weight. In the state of Maine it is esteemed more than any other species of resinous wood for the knees of vessels, and is always used for this purpose when proper pieces can be obtained. This wood is justly appreciated in the United States, but it is little employed because it is rare and may be replaced with other species which are cheaper and more abundant. *Sylva Americana.*

Vegetable Silk.

The bark of the Papyfera, a species of the mulberry tree, not only furnishes fibres for ropes, but can even be formed into cloth. M. la Rouverie affirms, that he procured a beautiful vegetable silk from the young branches of this tree; cutting the bark while the tree was in sap, and then beating it with mallets and steeping it in water, he obtained a thread from the fibres, almost equal to silk in quality, and this was woven into a cloth whose texture appeared as if formed of that material. The women of Louisiana obtain a similar production from the offshoots of the mulberry; these are gathered when they are about four or five feet high. The bark is stripped and dried in the sun: it is then beaten, to get rid of the external part, which falls off, leaving the inner bark entire. This is again beaten, to make it still finer, after which it is bleached in dew. It is then spun, and various fabrics are made from it, such as nets and fringes; and sometimes it is woven into cloth. The finest sort of cloth among the inhabitants of Otaheite and other of the South Sea Islands, is made of the bark of this tree.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR MAY, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inch.*
1	40	52	44	29.98	29.90	29.90	Cloudy	Cloudy	Fair	S. E.	S. W.	N. W.	
2	40	42	43	30.02	30,05	30.10	Fair	Fair	Cloudy	N. W.	E.	S. W.	
3	44	50	48	30.10	30.10	30.10	Cloudy	Fair	Cloudy	S. W.	E.	S. W.	
4	46	52	57	30 03	29.90	29.72	Cloudy	Fair	Rain	S. W	N. E.	S. W.	
5	42	50	46	29.70	29.73	29.95	Cloudy	Cloudy	Fair	N. E.	N. E.	N. E.	.60
6	41	48	40	30.20	30.25	30.40	Fair	Fair	Fair	N.E.	E.	S. E.	
7	38	49	39	30 50	30 50	30.45	Fair	Fair	Fair	S. W.	E.	S. W.	
8	42	69	55	30.40	30.30	30.28	Cloudy	Fair	Cloudy	S. W.	S. W.	S. W.	
9	56	68	56	30.20	30.22	30.25	Cloudy	Cloudy	Fair	S. W.	N. W.	N. W.	08
10	50	56	46	30.39	30.45	30.50	Fair	Fair	Fair	S. W.	E.	N .W.	
11	40	54	47	30.51	30.52	30.48	Fair	Fair	Fair	N. W.	E.	S. W.	
12	42	75	60	30.39	30.30	30.28	Fair	Fair	Fair	S. W.	S. W.	S. W.	
13	56	78	62	30.22	30.22	30.20	Fair	Fair	Fair	W.	E.	S. W.	
14	60	80	66	30.18	30.18	30.12	Fair	Fair	Fair	S. W.	S. W.	S. W.	
15	63	80	60	30.08	30.02	29.90	Cloudy	Fair	Rain	S. W.	S. W.	S. W.	
16	60	76	60	29.90	29.91	30.01	Fair	Fair	Fair	W.	N. W.	N. W.	
17	52	72	60	30.07	30.08	30.02	Fair	Fair	Fair	W.	N. W.	N. W.	
18	56	56	53	30.02	30.04	30.02	Cloudy	Fair	Fair	N. E.	E.	S. W.	
19	50	50	46	30.01	30.00	29.92	Cloudy	Cloudy	Rain	S. W.	E.	E.	.72
20	51	50	48	29.78	29.80	29.65	Rain	Rain	Rain	S E.	N. W.	N. E.	.55
21	49	52	50	29.43	29.52	29.70	Rain	Cloudy	Fair	N. W.	N. W.	S. W.	1.29
22	49	50	44	29.72	29 91	30.04	Cloudy	Cloudy	Rain	N. W.	N. W.	N. E.	
23	42	50	41	30.10	30.11	30.11	Cloudy	Fair	Cloudy	N. E.	E.	E.	,01
24	43	44	39	30 05	30.02	29.95	Cloudy	Rain	Rain	E.	N. E.	N. E.	
25	56	38	40	29.83	29.75	29.80	Rain	Rain	Rain	N. E.	N. W.	S. W.	.20
26	44	51	44	29.69	29.69	29.69	Clou d	Rain	Rain	W.	N. W.	S. E.	.44
27	44	44	42	29.60	29.59	29.76	Rain	Rain	Rain	N. E.	N. E.	N. E.	
28	44	60	49	29.80	29.85	29.90	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	.77
29	46	68	55	29.97	29.97	29.95	Fair	Fair	Fair	N. W.	N. W.	S. W.	
30	51	58	48	29.79	29.61	29.61	Cloudy	Rain	Cloudy	S. W.	S. W.	N. E.	.87
31	48	46	46	29.68	29.90	29.91	Rain	Rain	Rain	N. E.	N. E.	N E.	.43

Depth of rain fallen 5.96 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

A Microscopic View of a drop of Water with the different Animalculæ magnified 4000 times with the 2nd power of C. Gould's Improved Pocket Compound Microscope.

Pendleton's Lithography Boston

THE NATURALIST.

AUGUST, 1832.

THE MICROSCOPE.

NO. II.

ACTIVE MOLECULES

In Organic and Inorganic Bodies, discovered by Robert Brown, Esq. F. R. S. &c. &c. &c.

This indefatigable gentleman, in prosecuting his elaborate researches into the vegetable kingdom, was led to infer (from circumstances connected with the investigation of the pollen of plants suspended in water,) that the same active molecules might likewise exist in inorganic bodies; he has not been disappointed, having succeeded in separating them from almost every known substance, such as minerals, glass, common dust, soot, *&c. &c.*; indeed, the principal exceptions are oil, resin, wax, sulphur, such of the metals as could not be reduced to that minute state of division necessary for their separation, and finally bodies soluble in water.

The process of obtaining a satisfactory view of these minute active molecules is exceedingly simple, and is as follows: with the head of a pin place a small drop of distilled or filtered water upon a slip of glass, then apply the head of the pin (again dipped in the water) to the substance from which the molecules are to be separated, which is effected by a slight friction: afterwards im merse the head of the pin in the water upon the slip of glass,

gently agitating it; this will occasion the molecules to be transferred to the water upon the glass, which is then in a state to be submitted to the deep powers of the microscope: to separate the molecules from the glass itself, either pound it very fine, or gently rub together the unpolished edges of two pieces, having previously wetted them—the produce can then be transferred to a drop of water.

The figure of the molecules is spherical: they are so minute that four hundred millions of them would not occupy greater space than a superficial square inch. Their motion is very vivid, and consists, not only of a change of place in the fluid, manifested by alterations in their relative positions, but also, not unfrequently, of a change of form in the particle itself; each molecule appears to revolve upon its axis: in fact, the whole of the motions are very similar to those of the most minute kind of animalcules inhabiting water.

Some persons have considered the motion to result from the evaporation of the fluid and the action of the breath of the observer upon its surface: this is proved not to be the case, by covering the water with a thin piece of talc, when the motions continue unaltered; it has likewise been urged that these spherical molecules may be hollow, and that the motion is produced by the water entering them, thereby displacing the air contained in them—were this the case, the action must soon subside, which does not take place: besides, the molecules are proved to be suspended *within* the fluid, by bringing the surface to the true focus, when a variety of *irregular* particles (distinct from the molecules) will be discovered evidently acted upon by exterior causes.

When it is considered that there is not the slightest difference in the general figure of these active molecules (let the substance be what it may, from which they are separated,) it will be conceded that their identity gives them a character which makes it difficult to prove their figure and motions to be the result of mere chance, exterior mechanical causes, or optical delusion; this has been kindly shown by Mr. Brown to the editor, who is perfectly of that gentleman's opinion.

INFUSARIA, OR ANIMALCULES IN VEGETABLE INFUSIONS. The smallest living creatures we are acquainted with, are the animalcules in fluids; they afford a wonderful scope for inquiry, and nothing is more capable of affording instruction combined with amusement, than researches into the secrets of Nature in the more minute parts of her works; and it presents to view the most surprising wonders hitherto unknown; for who would or could have imagined that, in a single drop of water, thousands of living crea-

tures are found, most of them invisible to the naked eye, and so extremely minute, that many thousands of them will not cover the space of a grain of sand; the littleness into which Nature descends in these productions, nevertheless, offers one of the most agreeable subjects for instruction and admiration; for by comparing one of these minute living creatures with a larger animal, whose appearance is terrific, what a disproportion is observable, and what efforts of the imagination does it not require to conceive the smallness of the parts of this minute living creature, for it will appear they are furnished with as many or more members than the largest animal: they must have the means for the circulation of the blood, a stomach for receiving their food and digesting it;—in a word this little world contains objects, of the number and variety of which we cannot have the smallest idea without the assistance of the microscope.

CLASS OR DIVISION OF THE ANIMALCULA INFUSARIA.

Those that have no External Organs. 1. Monas punctiforme; a mere point. 2. Proteus mutabile; mutable or changeable. 3. Volvox; spherical. 4. Enchelis cylindraceum; cylindrical 5. Vibrio elongatum; long.

Membranaceous. 6. Cyclidium; oval. 7. Paramæcium; oblong. 8. Kolpoda; crooked. 9. Gonium; with angles. 10. Bursaria; hollow like a purse.

Those that have External Organs. 11. Cercaria; with a tail. 12. Trichoda; hairy. 13. Kerona; horned. 14. Vorticella; the apex ciliated.

EQUIVOCAL OR SPONTANEOUS GENERATION. Equivocal or spontaneous generation, that is, the production of plants without seeds, and of living creatures without any other parents but accident and putrefaction; such was the absurd opinion that prevailed of the production of the minute living creatures, before the microscope overturned it, by demonstrating that all plants have their seeds, and all animals their eggs, whence the same species are produced. Nothing seems more contrary to reason than to suppose that chance should give being to regularity and beauty, or that it should create living animals, fabricate a brain, nerves, and all the parts of life; and, as Mr. Baker observes, we may as well suppose that the woods generate stags and other animals that inhabit them, as that a cheese generates mites without the egg. The growth of animals and vegetables seems to be nothing more than a gradual unfolding of their parts till they obtain their full size. Though water, by merely standing a few days, will be found to contain them, yet they will not be found in any degree so numerous as when vegetable bodies have been steeped therein, for no

living creatures seem to subsist upon water alone; but when it is stored with their proper food, myriads may be found in every drop, of the greatest variety in their forms; some are round, some oblong, and others spherical, and the greatest part of them transparent: motion seems to be their greatest delight; they pervade with ease and the greatest rapidity the whole dimensions of the drop of water, in which they find ample space; sometimes they dart forwards, and at others move obliquely, then again in a circle, and though hundreds may be seen in a single drop, yet they never strike against one another: they differ in their size; some are barely visible to the eye; some so minute as to resist the action of the microscope, and appear only as moving points; of this description is the monus; it is so extremely delicate and transparent as sometimes to elude the highest magnifying power: some are no doubt inhabitants of the water, and others turn into small flies, and deposit their eggs in any kind of fluid producing proper nourishment for their young; the eggs being hatched, they live a certain time in this element, then take wing after a complete change in their forms; this may often be observed, for when they grow to a certain size, of a sudden you will find them gone, and a small race supply their place.

As these infusions to produce them, are all prepared in a similar manner, and as the two following substances may be procured without much trouble, and generate the most remarkable subjects, we shall describe the necessary preparations.

Hay. The infusion of hay produces the greatest variety of animalcules, and by far the most curious; all those described in the plate may at different times be found in this infusion. Twist up a little hay, and press it down into a teacup or any other vessel; cover it with water to the top, and if it absorbs the water, put fresh in; in a few days, in summer, a scum will appear on the top; take from the surface, with the spoon at the end of the forceps, a single drop, and place it between the glasses; it will be found to contain extremely minute animalcules: in a few days they increase in size, and in about ten days they obtain their full growth. It is impossible to enumerate the variety that may be discovered at different times in this infusion; the most numerous are in the shape of an egg, fig. 1. Pl. 8. and with a high power a great number of small feet may be discovered, and at the head a number of fabrilla, which are continually in motion, creating a vortex in the water which brings their prey towards them, which may be discerned many hundred times less than themselves; they use their legs in running as well as swimming, for by placing a human hair across the water, as fig. 2, a number of them will be seen running along

it. We shall find another sort in the shape of a soal, without the appearance of any legs, fig. 3; and many others, which are described in the following pages. The eggs or spawn may be seen, with a high power, attached to any small portion of matter in the drop of water.

Pepper. Put common black pepper bruised into an open vessel, enough to cover the bottom, pour water upon it about an inch deep, stir them together when first mixed, and afterwards let them remain still. In a few days, in warm weather, a scum will appear on the top; take a single drop from the surface, and place it on the glass. It sometimes happens that such multitudes are in a single drop, that it becomes quite opaque; in this case, dilute it with a drop of pure water.

The following substances produce different descriptions of animalcules:—senna, Indian wheat, cabbage, raspberry stalks, all kinds of flowers, grasses, *&c.*, oatmeal, bran, *&c.* Also water in which flowers have been standing for any length of time.

Bell-shaped Polype. During all the months in summer, and particularly in April, a great abundance of these curious insects are to be found on the shells of the small water-snail, duck-weed, and other water plants, and on the larvæ of the larger insects, in such multitudes at times, as to appear like a fine down upon them; they are extremely minute, and generally fasten themselves by their tails in groups of twenty or more, extending themselves in every direction, in search of food, and are not unlike a bunch of tulips; they spring back with a sudden contraction, which is no doubt when they have caught their prey; if they are touched or disturbed, the whole of them contract themselves, as fig. 24. The various species are nearly alike, as to the above particulars, but greatly differ with regard to their size; but none are more interesting than those shown in the plate, fig. 6; when these little animals stretch themselves out, and open their anterior ends, each appears like a bell, with a rim or lip furnished with a number of fibrelle, and vibrate so quickly, that it requires a strong power to see them; it creates a vortex in the water, which reaches to a great distance, in proportion to its size. But though they are found thus joined together in colonies, each head is a perfect insect, and can detach itself from the rest, live separate, and become the parent of a new colony, as most of them do after a certain time; for by attentively examining them, they may be seen swimming about the drop of water separately. When a number of them are fixed to a body, they appear of a whitish color to the naked eye, but through the microscope transparent, with spots upon them.

Bell-shaped Polype found in Hay. After hay has been

infused for some weeks in water, an extremely minute bell-shaped polype is found, among a variety of others, as in fig. 4, and requires the greatest power of the microscope to discover their form, for their tails must be many thousand times less than the finest hair of the head. As seen in the plate, they are magnified in bulk six thousand four hundred times, whereby we may form some conception of their minuteness; yet small as they are, they live upon animalcules many hundred times less than themselves.

THE SMALL SNAIL WITH SPIRAL SHELL. This description of snail may be procured in ponds and ditches: the more transparent the better. They may be kept alive for months in a large glass vessel; and it is common for them to fasten their spawn in little masses against the sides of the glass, where the eggs hatch in about three weeks or a month. The spawn appears like a transparent jelly; but, examined by the microscope, you may discover a number of oval pellucid bodies, having each of them a dark speck: this speck becomes a perfect snail, and, a few days before hatched, may be seen, in a perfect state, turning about in the fluid that encloses it; the heart also may be distinctly seen, the pulsation proceeding under the eye with great exactness and regularity, forming a most beautiful spectacle; a number of the bell-shaped polype generally attach themselves to the snail.

THE PROTEUS. None of the many different animalcules I have yet examined have afforded so much pleasure, perplexity and surprise, as the curious insect I am about to describe, which has so wonderful a capability of assuming different shapes, that nobody without actually seeing its changes would believe it to be the same creature; it may be found in water where any kind of vegetable bodies have been infused, and has stood for several weeks: if it is in any glass vessel, a slimy substance will be collected about the sides; some of this being taken off with the point of a knife, and placed on the slip of glass in a drop of water, it will be found, upon looking at it through the microscope, to harbor several kinds of animalcule; the proteus will most likely be seen among them, and is thus described by Mr. Baker:—'After having been examining some of this matter for sometime, which I found plentifully stocked with various kinds of animalcules, a little creature suddenly made its appearance among them, whose figure was entirely new to me, moving about with great agility: the body was elliptical, with a slender fine-proportioned neck, similar to a swan's. Fig. 19 is a representation of this extraordinary insect. It moved its head backwards and forwards, seemingly in search of its prey. After viewing it for sometime with a low power, wishing to change it for a greater, which took up sometime, it was lost to view, and

nothing was seen the least resembling it. Some weeks after, examining some more of this slimy matter, again the same kind of insect made its appearance; after watching it for sometime, it suddenly changed its form,—it drew in its neck, and only the body appeared; another change then quickly took place,—it thrust out its head, as in fig. 20, with wheel-work machinery.

The Monoculus, or Water-flea. So numerous is this insect in the summer months, that the waters will appear tinged, sometimes red and at others green, owing to myriads of these insects upon the surface. It is the size of the common flea when full grown, but is a much better object for the microscope when young, as it is then not larger than a mite, but much more transparent, and the motion of the inside is clearly visible. The pulsation of the heart may also be distinctly seen. Its head is extremely small, and the eye is situated on the trunk. It has two arms, or legs, which it waves as a bird moves its wings, and, by striking the water, it rises or descends with great rapidity.

The Hydra, or Polype. The nature of this insect is extremely singular, and contrary to the general principle of life; for if the polype be cut into any number of pieces, each piece will become a perfect creature, having all the functions of animal life. Hydra were first discovered by Mr. Trimley, who took them for plants, and saw, as he imagined, young shoots or branches coming out; at last he perceived them devour smaller insects; he cut one of them in two, and, in a few days, new arms were growing out of the part he had cut away; these insects have since been divided in every way with similar effect. The green polype, which is most common in this country, is about half an inch in length, and its arms are placed in a circle round its mouth. This kind is found crawling on the ground in clear running water, or on water plants, hanging by its tail, and extending its arms in search of food. The hydra, or polype, (put into a glass vessel with other water insects and a quantity of duck-weed,) may be kept alive for months.

The Ephemera. This is another curious insect in the larva state, and is found either in ponds, or among the aquatic weeds that grow by their side. The ephemera, in its perfect state, which is that of a fly, seldom exists more than one day; within this short period it performs all the functions of other insects, and then expires. There is a great variety of this tribe, all very beautiful; the most common species is found in gardens, and is a slender-bodied fly, of a grass-green color, with large bright gold eyes and four wings. It is about the size of a large common gnat. Great care is requisite in securing them, as they are extremely

tender; the best way of holding them for examination by the microscope, is by the wings, in the spring forceps. When they are in the larva state, a watch-glass half filled with water is the most convenient; the smallest species are best adapted for this purpose, as being the most transparent; they have seven paddles on each side.

Luminous Water Insects. The Rev. Mr. Baker, in his observations on luminous insects in water, says that he has been surprised sometimes at the sparks of light to be seen on the shells of oysters, on removing them, when fresh taken from the sea. He bestowed some pains to find out the cause, and was perfectly convinced, after many examinations, that it arises from a minute insect, the length of which is about one eighth of an inch: the head is armed with a pair of forceps; the body consists of twenty-eight joints or divisions, each having a pair of feet belonging to it. This little insect can èmit or conceal its light, and is very similar to the glow-worm.

Sea-water. Another account is given by Dr. Veanella, of Chioggea, in Italy. In his inquiry into the shining of sea-water in the night, which he says is seen with wonder in the lakes of Chioggea, where sea-weeds abound, he relates that he brought from thence, one summer's night, a bottle of the water, which, being stirred in the dark, sparkled; but, after being filtered through a cloth, afforded no light at all, while the cloth was covered with shining particles, which, being examined by the microscope, were discovered to be living insects, formed something like a caterpillar, with ringlets on the body; from the head issued two horns, and the tail appeared twisted. These insects are entirely luminous, and when at rest do not shine at all, but send forth a great light as soon as they become agitated.

Vorticella, or Wheel Insect. This surprising insect is found in leaden gutters, not exceeding the size of a grain of sand; you may often discover it in ponds, ditches, upon duck-weed, &c., and in water that has stood sometime in vessels in the house, adhering to the sides, and in the infusion of hay: if the water or the sediment in gutters has a red appearance, you will most likely find some: the minuteness of these insects makes it impossible to know whether you have them or not without examination with the glasses. The best way of discovering them is by placing some of the sediment under the low power of the microscope. If you find any there, then screw on a higher power, and watch their motions with attention. This little creature shows itself first like a transparent maggot, lengthening out its body at times, and at others contracting it,—changing again its form in an instant, as figs.

9 and 21. Every part seems capable of great extension and contraction: to examine the wonderful mechanism of its parts will afford hours of amusement; it being transparent, the motion of the heart and other internal parts may be seen: it appears continually to be hunting after its prey, has a large mouth, and is furnished by nature with an amazing piece of machinery or wheel-work to procure its food; the wheel-work projects from the head, and turns round with great velocity, causing a rapid current of water to be brought from a considerable distance to its mouth, and by this means supplying it with food; as these wheels are transparent, it is very difficult to determine by what contrivance they move, or what their real figure is. Though they seem exactly to resemble wheels moving round upon an axis, as the insect is capable of thrusting these parts out or drawing them in at pleasure, their figure is completely altered by so doing, and they appear in the various forms represented in figs. 8, 9, 10.

Sometimes they turn themselves into round globules or balls, when done feeding: they then draw in their wheels, and their tails remain fastened to the slip of glass they were placed on, as in fig. 7. All their actions seem to imply sagacity and quickness of sensation, for at the least touch or motion in the water, they draw in their wheels: though small creatures, they may be compared to whales in proportion to some of the animalcules in the same drop of water; these are their prey, which they draw towards them by the current of water which their wheels excite, fig. 9. None of them can cross this current without being drawn into its mouth. Some of them have eggs or spawn attached: and by procuring a number of them, and watching them attentively, the young one may be seen to burst the egg, and gradually force its way out, fig. 12, in doing which, it is greatly assisted by the tail of the parent, for by moving it to and fro, and striking the shell, it breaks the egg, and the young one, by the assistance of its wheels, is thus enabled to force its way.

A small species of the wheel insect is found in the infusion of hay, after sometime standing, as in fig. 5. This animalcule possesses the wonderful property of retaining life for years when out of the water; in this state, life may be said to be latent, but, shortly after the insect is placed in water, it resumes its functions and becomes as active and vigorous as before.

The Satyr, or small Water Spider In ponds, and in several infusions, a little crustaceous insect is to be found, fig. 13. The shell is so exceedingly transparent, that it can hardly be discerned—it covers the whole of its back. Four legs or fins

serve it to walk or swim; but it generally creeps along at the bottom of the drop.

Fig. 14 represents an aquatic animal; its appearance to the naked eye is like a slender worm, about one tenth of an inch in length, but the microscope shows its real form; from the head a long proboscis extends, and is moved every way with great readiness; the head is of a yellowish color, the rest of the body transparent, and long tufts of hair grow from it; the blood circulates in the middle of the body, running towards the tail.

Paste Eels. Those who are desirous to be furnished with a curious living object for the microscope, should be provided with the eels in paste: they are, after the paste has been made for some weeks, so numerous, that the whole surface of it appears alive, and by taking from the surface with a point of a needle the smallest particle, and putting it in a drop of water, it will be found to contain a number of these minute eels, fig. 17, with a continued regular motion swimming about the drop of water. A curious experiment may be performed by separating one of the larger sort from the rest; by placing it in another drop of water by means of a fine point of a quill; it may then be easily cut asunder by a fine lancet, and if the division is made about the middle of the animal, several oval bodies will be seen to come forth, as in fig. 18; these are the young, curled up in a fine membrane: the largest and most forward break through it, unfold themselves, and swim away; numbers have been seen to issue from one single eel, which accounts for their great increase. The question is, by what means do they first get into the paste; if an egg were in the flour, the operation of boiling the paste would certainly destroy them, but it is a most extraordinary fact, that they will live in a degree of heat above one hundred; and in paste too hot to bear the finger in. In viewing the paste eel with deep powers, there is no necessity to produce an elevation between the glass and the talc, as the paste although diluted with water, answers that purpose—place a drop of water upon the glass, into which introduce a small quantity of the paste, covering both with a very thin piece of talc: prepared in this way, any power may be applied with effect: in fact, the paste eel is a good object for the deepest powers.

Vinegar Eels. A small eel may likewise be found in the dregs of vinegar, that moves much quicker than the above.

Eels in Blighted Wheat. These animalcules are not usually lodged in such blighted grains of wheat as are covered externally with a soot-like dust; but abundance of ears may be observed in some fields having grains that appear blackish, as if scorched, and, when opened, are found to contain a soft white substance.

This, examined attentively, seems to be nothing else but a knot of threads lying as close as possible to each other; this fibrous matter discovers no sign of life, but, upon applying water to it, the supposed fibres separate, and prove to be living creatures, by motion at first languid, but gradually more vigorous.

The Globe Animal. Fig. 15 represents this very singular water animal, as it is seen before the microscope; its form seems exactly globular, having no appearance of head or tail; it moves in all directions, sometimes slow, and at other times very swift, then swimming like a top; the surface of the body seems dotted all over with little points, and beset round with hairs, which are no doubt their means of motion.

CONCHOLOGY.

NO. VI.

Of the Production of Pearls. In treating of the constituent parts of shells, it was observed that the composition of the pearls, appears, from analysis, to be precisely the same as the mother-of-pearl, or those shells in which the pearl is usually found. From this we must conclude, that the pearl, and the mother-of-pearl, are produced by the same secretion. It appears, from the observations of naturalists, and indeed it might have been expected, from the similarity of composition, that all testaceous animals, whose shells come under the description of mother-of-pearl, occasionally produce pearls.

Different opinions have been entertained with regard to the cause of the formation of this precious production. According to some, it is merely a morbid concretion, formed within some part of the body of the animal, or at least within the shell, without any apparent external injury; while others suppose that it is only owing to wounds which the shell, or the animal, or both, have received from accidental causes, or from the action of insects or some testaceous animal, making perforations in the shell. It is not improbable that pearls may be formed in both ways.

Every day's experience informs us, that similar concretions are formed in different cavities of the bodies of other animals, but without any obvious cause, or external injury. The formation of such concretions, as, for instance, biliary and urinary, calculi, producing the most excruciating disorders in the human body, are

too fatally known. These concretions, no doubt, owe their origin to the diseased or unhealthy action of the vessels secreting the fluids in which they are formed. By this diseased action producing a super abundance of the matter, which enters into the composition of the concretion; or this matter in the fluid state, meeting with some solid body, which becomes a nucleus, is attracted by it, and deposited in concentric layers, till the concretion acquires a larger or smaller size, according to the duration and quantity of the secretion and deposition. In the same way, it seems extremely probable the pearl may be frequently formed; the matter of which it is composed, being constantly secreted by the animal for the production of the new part of the shell. If then, this matter should at any time be produced in greater quantity than what is necessary to form the inner layers of the shell, and particularly if it should meet with a solid particle of any body, it will be attracted by it, and thus constitute the rudiments of a pearl, which will receive constant additions of concentric layers, and increase in size, in proportion to the age of the animal, and the quantity of matter deposited. Pearls, it is said, have been found within the body of the animal. If this be true, the pearly matter, in its passage through the vessels of the body, must have met with some nucleus, around which the concentric layers have been founded. In most cases, however, the pearl is found loose in the shell, entirely detached from the animal. It must then have been formed of the matter, which was thrown out of the body, but it is not unlikely that pearls are found both ways, or that the same pearl may be partly formed within the body of the animal, and be afterwards excluded, and arrive at its utmost size, while it remains loose in the shell.

But according to others, the pearl owes its formation to some external injury. The following seems to be a pretty distinct view of this opinion. When Taujas de St. Fond visited Loch Tay, he was led to make some inquiries concerning the pearl fishery, which had been carried on in several parts of the river Tay for some years. Shells were brought to him, and in these shells the fishermen pretended to find pearls, which they expected to sell at a higher rate, as they were found in the presence of the traveller. But he informs us, that they attempted to impose on him, by introducing a pearl secretly into the shells as they opened them. Observing this circumstance, he told them that he could know at once, by examining the outside of the shell, before opening it, whether it contained any pearl. He mentions this to introduce some speculations concerning its formation. When no perforation or callosity appeared on the outside, he concluded that there was

no pearl in the shell. The pearl fish, he supposes, is attacked by two classes of enemies. One is what he calls the *anger worm* which penetrates into the inside, near the edge of the valve, by making a longitudinal passage, between tbe layers of the shell. The length of the channel is one inch, or one inch and a half, when it doubles back in a line parallel to the first. At the inner extremity there is a small circular portion formed by the worm in turning round. These excavations are in the pearly part of the shell. The pearly juice extravasating, forms protuberances in the same direction; and the cylindrical bodies which are thus formed, may be considered as elongated pearls, adhering to the internal surface. When several worms of this kind, unite their labors, by penetrating near each other, the result is a kind of pearls, even with irregular protuberances.

Another sea worm, which he says belongs to the multivalves, a species of pholas, also attacks the pearl shells. The shell of this species of pholas has a hinge in the form of a crooked bill, as he saw in some species of oyster, which he examined, from the coast of Guinea. The hole was of the shape of a pear. Pearls of this shape have been found, and have been held in great estimation. Observing this circumstance, artificial perforations are made in the shell, and this forces the animal to produce pearls. In some shells brought from China, this artificial hole has been observed filled up with brass wire, rivetted on the outside like a nail, and the inner extremity of the wire with a well-formed pearl, which seemed as if soddered to its extremity.

Pearls are also produced by another artificial process. The shell is opened with great care, to avoid injuring the animal, and a small portion of the internal surface of the shell is scraped off. In its place is inserted a spherical piece of mother-of-pearl, about the size of a small grain of lead shot. This serves as a nucleus, on which is deposited the pearly fluid, and in time forms a pearl. Experiments of this kind have been made in Finland, and have been repeated in other countries.

A remarkable discovery has been ascribed to Linnæus respecting the generation of pearls. This was a method which he found out, by putting the pearl muscle (*Mya margaritifera*) into a state of producing pearls at his pleasure. It was some years, before the final effect could take place; but in five or six years after the operation, the pearl, it is said, had acquired the size of a vetch. But it does not seem to be known in what this operation consisted. Whether it consisted in imitating the process of insects, by wounding the shell from the outside, or by following the other process, by scraping away part of the inner layer; nor is it much known

what have been the effects of this operation, or whether it has turned to any account, or indeed is it at all practised in Sweden or in any of the northern states where it must have been originally known. For this discovery however, the Swedish naturalist, it is said, was raised to the rank of nobility, and otherwise liberally rewarded by the states of the kingdom.

The valve which is put on the pearl, depends on its size, color, shape, and purity. The largest pearls are always held in the highest estimation, when their other qualities are in any degree of perfection. The finest shape of the pearl must be quite globular; it must be of a clear brilliant white, smooth and glossy, and entirely free from spot or stain. Pearls were greatly esteemed, and much sought after by the Romans. Servilia, the mother of Marcus Brutus, we are informed, presented a pearl to Cæsar, which was valued at 50,000 lbs sterling; and Cleopatra dissolved one, which is said to have been worth 250,000 lbs sterling, in vinegar, which she drank at a supper with Mark Antony.

ORNITHOLOGY.

NO. VIII.

Flight of Birds. The flight of birds differs exceedingly; some fly by jerks, closing their wings every three or four strokes, which gives them an undulated motion, very conspicuous in the woodpeckers and wagtails, [and in most small birds; others fly smooth and even; and some appear to buoy themselves in the air without perceptible motion of the wings, such as the kite and hawk. Most birds fly with their legs contracted, with their neck extended; but there are some whose length and weight of neck makes it necessary to contract it in flight, in order to bring the centre of gravity on the wings; to aid which the legs are also extended behind, as in the heron and bittern; others fly with extended neck, but are obliged to throw out their legs behind as in the duck, goose, and other water fowl.

It is recorded that a falcon belonging to Henry IV., King of France, which escaped from Fontainbleau, and in twenty-four hours after was found in Malta, a space computed to be not less than 1350 miles, a velocity equal to 57 miles an hour, supposing the hawk to have been on wing the whole time. But as such birds never fly by night, and allowing the day to be at the longest,

or to be of eighteen hours' light, this would make seventy-five miles an hour. It is probable, however, that he neither had so many hours of light in the twenty-four, to perform the journey, nor that he was retaken at the moment of his arrival, so that we may fairly conclude much less time was occupied in performing that distant flight.

Those who have attended to the flight of birds, know that a sparrow will fly at the rate of more than thirty miles an hour. It is indeed extremely difficult to ascertain the actual distance a falcon may fly in a given space of time, when in pursuit of its quarry. It has been estimated, however, that one in pursuit of a snipe flew nine miles in eleven minutes, independent of the numerous turns; and the force with which they strike, in the utmost of their velocity, is so great, that a hawk has been known to cut a snipe in two parts.

The rapidity with which a hawk, and many other birds occasionally fly, is probably not less than at the rate of one hundred and fifty miles an hour, when either pursued or pursuing, and their powers fully exerted; and certainly one hundred miles is not beyond a fair computation for migratory continuance, not only of the hawk, but of the woodcock, snipe, and other similar birds. Some years ago an experiment was made in the vicinity of Portsmouth, N. H. with a pigeon, to ascertain the rapidity of her flight. She was taken from her young and carried to the distance of eighty miles into the country. After she had been kept there for several days, she was liberated; and no sooner was she out of the hands of her keeper, than she made her way vertically into the air with the velocity of lightning, and shortly disappeared. In about forty-five minutes after, she was seen at the side of her nest feeding her young ones.

Among quadrupeds, the horse is perhaps as fleet as any, and yet the velocity falls very short of that of a bird; the famous racer, *Hambletonian*, covered a space of four miles in eight minutes, which is but thirty miles an hour, if it could be continued. *Eclipse* is said to have gone at the rate of a mile a minute for a short distance.

THE MOCKING BIRD.

(*Turdus polyglottus*, Lin. Wilson, ii. p. 13. pl. 10. fig. 1. Audubon, pl. 21. [a spirited group and nest attacked by a rattlesnake.] *Orpheus polyglottus*, Swainson. Philad. Museum, No. 5288.

Specific Characters.—Cinereous; beneath whitish; tips of the wing-coverts, primaries at base, and lateral tail-feathers, white; tail cuneiform.

This unrivalled Orpheus of the forest, and natural wonder of America, inhabits the whole continent, from the state of Rhode Island to the larger isles of the West Indies, and continuing through the equatorial regions, is found in the southern hemisphere as far as Brazil. Nor is it at all confined to the Eastern or Atlantic states. It also exists in the wild territory of Arkansa more than a thousand miles from the mouth of Red River. It breeds at the distant western sources of the Platte, near the very base of the Rocky mountains;* and Mr. Bullock saw it in the table land of Mexico. The mocking bird rears its young, and consequently displays its wonderful powers, in all the intermediate regions of its residence in the United States to the peninsula of Florida.† It appears, in short, permanently to inhabit the milder regions of the western world in either hemisphere;‡ and the individuals bred north of the Delaware, on this side the equator, are all that ever migrate from their summer residence. A still more partial migration takes place also, probably, from west to east, in quest of the food and shelter which the maritime districts afford. Though now so uncommon in that vicinity, fifty or sixty years ago, according to Bartram, they even wintered near Philadelphia, and made a temporary abode in the mantling ivy of his venerable mansion. In summer, a few proceed as far as Rhode Island, following the mild temperature of the sea coast; but further north, they are, I believe, nearly unknown, except rarely and occasionally in Massachusetts. With the advance of the season, also, in the country which it inhabits, varies the time of incubation. Early in April they begin to build in the maritime parts of Georgia, but not before the middle of May in Pennsylvania.

In the winter season they chiefly subsist on berries, particularly those of the Virginia juniper (called red cedar,) wax myrtle, holly, smilax, sumach, sour gum, and a variety of others, which fur-

* Mr. Say. † Mr. Ware.

‡ Mr. Litchfield informs me, that the song of the mocking bird is commonly heard in Venezuela, where of course it breeds and permanently resides.

nish them, and many other birds, with a plentiful repast. Insects, worms, grasshoppers, and larvæ, are the food on which they principally subsist, when so eminently vocal, and engaged in the task of rearing their young. In the Southern States, where they are seldom molested, with ready sagacity they seem to court the society of man, and fearlessly hop around the roof of the house, or fly before the planter's door. When a dwelling is first settled in the wilderness, this bird is not seen sometimes in the vicinity for the first year; but, at length, he pays his welcome visit to the new comer, gratified with the little advantages he discovers around him, and seeking out also the favor and fortuitous protection of human society. He becomes henceforth familiar, and only quarrels with the cat and dog, whose approach he instinctively dreads near his nest, and never ceases his complaints and attacks until they retreat from his sight.

On the 26th of February I first heard the mocking bird, that season, in one of the prairies of Alabama. He began by imitating the Carolina woodpecker, *tshooai tshooai*, *'tshow 'tshow 'tshow;* then, in the same breath, the *sweetoot sweetoot* of the Carolina wren; by and bye, *woolit woolit 'tu 'tu* of the cardinal bird, and the *peto peto peto* of the tufted titmouse, with connecting tones of his own, uttered with an expression so refined and masterly, as if he aimed, by this display of his own powers, to make those inferior vocalists ashamed of their own song. It was truly astonishing what a tender sweetness he contrived to blend amidst notes so harsh and dissonant as those of the woodpecker, which ever and anon, made, now, the chorus of his varied and fantastic song. In the lower parts of Georgia, by the beginning of March, they are already heard vying with each other, and with the brown thrush, rendering the new-clad forest vocal with the strains of their powerful melody.

Like the ferruginous thrush, to which he is so nearly related, the mocking bird chooses a solitary briar bush or a thicket for his nest; sometimes an orchard tree contiguous to the house is selected for the purpose, at little more than the height of a man from the ground. The composition of this cradle of his species is, generally, an external mass of dry twigs, leaves, and grass, blended with bits of decayed wood, and then surmounted with a thick layer or lining of root fibres of a light-brown color. The eggs are about four or five, pale green, with blotches of brown scattered nearly all over. The female sits fourteen days, usually producing two broods in a season, and is often assiduously fed, while so engaged, by the attentive male. She is jealous of her nest, and complains with a mournful note, their usual low call, when her

eggs have been touched, but does not readily abandon the spot she has once chosen.* None of the domestic animals, or man himself, but particularly the cat and dog, can approach, during the period of incubation, without receiving an attack from these affectionate guardians of their brood. Their most insidious and deadly enemies, however, are reptiles, particularly the black snake, which spares neither the eggs nor young. As soon, as his fatal approach is discovered, by the male, he darts upon him without hesitation, eludes his bites, and striking him about the head, and particularly the eyes, where most vulnerable, he soon succeeds in causing him to retreat, and by redoubling his blows, in spite of all pretended fascination, the wily monster often falls a victim to his temerity; and the heroic bird leaving his enemy dead on the field he provoked, mounts on the bush above his affectionate mate and brood, and in token of victory celebrates his loudest song.

The mocking bird, like the nightingale, is destitute of brilliant plumage, but his form is beautiful, delicate, and symmetrical in its proportions. His motions are easy, rapid, and graceful, perpetually animated with a playful caprice, and a look that appears full of shrewdness and intelligence. He listens with silent attention to each passing sound, treasures up lessons from anything vocal, and is capable of imitating with exactness, both in measure and accent, the notes of all the feathered creation. And, however wild and discordant the tones and calls may be, he contrives with an Orphean talent, peculiarly his own, to infuse into them that sweetness of expression, and harmonious modulation which characterizes this inimitable and wonderful composer. With the dawn of morning, while yet the sun lingers below the blushing horizon, our sublime songster, in his native wilds, mounted on the topmost branch of a tall bush or tree in the forest, pours out his admirable song, which, amidst the multitude of notes from all the warbling host, still rises pre-eminent, so that his solo is heard alone, and all the rest of the musical choir appear employed in mere accompaniments to this grand actor in the sublime opera of nature. Nor is his talent confined to imitation; his native notes are also bold, full, and perpetually varied, consisting of short expressions of a few variable syllables, interspersed with imitations, and uttered with great emphasis and volubility, sometimes for half an hour at a time, with undiminished ardor. These native strains bear a considerable resemblance to those of the brown thrush, with which he is so nearly related in form, habits, and manners; but, like rude from cultivated genius, his notes are distinguished by the rapidity of their de-

*Audubon's Orn. Biog. vol. i. p. 111.

livery, their variety, sweetness, and energy. As if conscious of his unrivalled powers of song, and animated by the harmony of his own voice, his music is, as it were, accompanied by chromatic dancing and expressive gestures; he spreads and closes his light and fanning wings, expands his silvered tail, and, with buoyant gaiety and enthusiastic ecstacy, he sweeps around, and mounts and descends into the air from his lofty spray, as his song swells to loudness, or dies away in sinking whispers. While thus engaged, so various is his talent, that it might be supposed a trial of skill from all the assembled birds of the country; and so perfect are his imitations, that even the sportsman is at times deceived, and sent in quest of birds that have no existence around. The feathered tribes themselves are decoyed by the fancied call of their mates; or dive with fear into the close thicket, at the well-feigned scream of the hawk.

Soon reconciled to the usurping fancy of man, the mocking bird often becomes familiar with his master; playfully attacks him through the bars of his cage, or at large in a room; restless and capricious, he seems to try every expedient of a lively imagination, that may conduce to his amusement Nothing escapes his discerning and intelligent eye or faithful ear. He whistles perhaps for the dog, who, deceived, runs to meet his master; the cries of the chicken in distress bring out the clucking mother to the protection of her brood.—The barking of the dog, the piteous wailing of the puppy, the mewing of the cat, the action of a saw, or the creaking of a wheelbarrow, quickly follow with exactness. He repeats a tune of considerable length; imitates the warbling of the Canary, the lisping of the indigo bird, and the mellow whistle of the cardinal, in a manner so superior to the originals, that mortified and astonished, they withdraw from his presence, or listen in silence, as he continues to triumph by renewing his efforts.

In the cage also, nearly as in the woods, he is full of life and action, while engaged in song; throwing himself round with inspiring animation, and, as it were, moving in time to the melody of his own accents. Even the hours of night, which consign nearly all other birds to rest and silence, like the nightingale, he oft employs in song, serenading the houseless hunter and silent cottager to repose, as the rising moon illumines the darkness of the shadowy scene. His capricious fondness for contrast and perpetual variety appears to deteriorate his powers. His lofty imitations of the musical brown thrush are perhaps interrupted by the crowing of the cock, or the barking of the dog; the plaintive warblings of the blue bird are then blended with the wild scream and chatter of the swallow, or the cackling of the hen; amid the simple lay of

the native robin, we are surprised with the vociferations of the whip-poor-will; while the notes of the garrulous jay, kildeer, woodpecker, wren, fifing Baltimore, and many others succeed, with such an appearance of reality, that we most imagine ourselves in the presence of the originals, and can scarcely realize the fact, that the whole of this singular concert is the effort of a single bird. Indeed, it is impossible to listen to these Orphean strains, when delivered by a superior songster in his native woods, without being deeply affected, and almost rivetted to the spot, by the complicated feelings of wonder and delight, in which, from the graceful and sympathetic action, as well as enchanting voice of the performer, the eye is no less gratified than the ear. It is, however, painful to reflect, that these extraordinary powers of nature, exercised with so much generous freedom in a state of confinement, are not calculated for long endurance; and after this most wonderful and interesting prisoner has survived for six or seven years, blindness often terminates his gay career; and thus shut out from the cheering light, the solace of his lonely but active existence, he now, after a time, droops in silent sadness and dies.

Successful attempts have been made to breed this bird in confinement by allowing them retirement and a sufficiency of room. Those which have been taken in trap cages are accounted the best singers, as they come from the school of nature, and are taught their own wild wood notes. The prices of these invaluable songsters are as variable as their acquired or peculiar powers, and are, from five to fifty dollars; even a hundred has been refused for an extraordinary individual. The food of the young is thickened meal and water, or meal and milk, mixed occasionally with tender fresh meat, minced fine. Animal food, almost alone, finely divided and soaked in milk, is at first the only nutritive food suited for raising the tender nurselings. Young and old require berries of various kinds, from time to time, such as cherries, strawberries, whortleberries, *&c.*, and, in short, any kind of wild fruits of which they are fond, if not given too freely, are useful. A few grasshoppers, beetles, or any insects conveniently to be had, as well as gravel, are also necessary; and spiders will often revive them when drooping or sick.

The young male bird, which must be selected as a singer, may be distinguished by the breadth and purity of the white on the wings. This white spot, in a full grown male, spreads over the whole nine primaries, down to, and considerably below their coverts, which are also white, sometimes slightly tipt with brown. The white of the primaries, also, extends to the same distance on both vanes of the feathers. In the female, the white is less

clear, spreads only over seven or eight of the primaries, does not descend so far, and extends considerably farther down on the *broad* than on the *narrow* side of the feathers. The black is also more inclined to brown.

The length of the mocking bird is nine and a half inches, and thirteen in alar extent. Individuals of the first brood in the season are larger and more robust than those produced later. Above ash-color, at length inclined to brown. The wings and tail nearly black, the first and second rows of coverts tipt with white; the primary coverts in some males are wholly white, in others tinged with brown. The three first primaries are white from their roots as far as their coverts; the white on the next six extends from an inch to one and three fourths farther down, and equally on both sides of the feather. The tail is wedge-shaped, the two outer feathers white, the rest, except the middle ones, tipt with white. Chin white; the remaining parts below, a brownish white, and clearer in wild than domesticated birds. Iris inclining to golden, but lighter. Bill, legs, and feet black; the base of the lower mandible whitish. The difference in the female is already given. The breast of the young is spotted like that of the thrush.

[The preceding article is from Mr. Nuttall's excellent work on Ornithology, which we had the pleasure of recommending to the notice of our readers a few months ago. We think it ought to be in the hands of every person who is forming a library, and sincerely wish that its circulation will be such as to amply pay the industrious and indefatigable author for his pains.]

MOUBRAY ON POULTRY.

[A Treatise on Breeding, Rearing, and Fattening, all kinds of Poultry, Cows, Swine, and other Domestic Animals. By B. Moubray, Esq. Reprinted from the sixth London Edition. With such Abridgements, and Additions, as, it was conceived, would render it best adapted to the soil, climate, and common course of culture, in the United States. By Thomas G. Fessenden, Esq. Editor of the New England Farmer; 12 mo. pp. 266. Boston: Lilly and Wait, Carter and Hendee.]

We are much gratified with the appearance of this useful work, and can safely recommend it to our agricultural friends, both from the abilities of the authors, and the importance of the subject as being highly deserving of patronage. The American author observes in his preface, that, 'The popularity, and extensive sale of *Moubray's Treatise on Poultry*, &c, afford infallible proofs of the

estimation in which it is held by the British public; and would seem to render an apology for reprinting it *verbatim*, in the United States, unnecessary. But a mere *copy* of the last English edition would embrace much matter, which could scarcely interest or amuse an American reader. A considerable part of the original work consists of local, personal, and transient topics;—of tales and anecdotes, the perusal of which would afford no profit, and not much amusement to readers in quest of *useful* information. These are omitted in the following work, and their place supplied by articles, original, or selected from the most authentic sources ' In treating of augmenting the quantity and quality of the food of animals, he remarks as follows:—

'The importance of *cooking* food for animals is not generally so well appreciated as it ought to be; nor is the principal cause or source of improvement, as well in quality as quantity of cooked food over its raw materials, known to every economist. The researches and deductions of philosophers and chemists, assure us that *water* supplies *food* for animals as well as plants. But, in order that water may yield its best and greatest effect as nutriment either for man or beast, it is necessary to *cook* it, or increase its nutritive powers, by the agency of heat; by which water, when combined with certain substances of vegetable origin, is converted into wholesome, palatable, and often *solid* food.

'It is a fact, which will be acknowledged as soon as stated, that a pound of Indian meal, of rice, or any other farinaceous substance, when boiled, contains more nourishment than several pounds in a raw state. Count Rumford has stated that "From the results of actual experiment it appears that for *each pound* of Indian meal employed in making a pudding, we may reckon *three pounds nine ounces* of the pudding.* And again, three pounds of Indian meal, three quarters of a pound of molasses, and one ounce of salt (in all three pounds thirteen ounces of solid food) having been mixed with five pints of boiling water, and boiled six hours, produced a pudding which weighed *ten pounds and one ounce.*†" Thus we gain from the raw material about three hundred per cent. in weight, and, no doubt, the gain as respects the quantity of nutriment contained in the pudding, over and above the component parts as they existed before boiling, was still greater. The gain of weight in rice, in consequence of boiling, is still more considerable than that of Indian meal, and every one knows that a small quantity of oatmeal, will produce a very great relative proportion of gruel.

'I will give other examples, proving that water is not only capa-

* Rumford's Essays, vol. i, p. 253, Boston ed.
† Rumford's Essays, vol. I, p. 264, Boston ed.

ble of being converted by heat into solid nutriment, but may be made to compose a constituent part of sugar, one of the most nutritious of substances. It is remarked by De Saussure, that, "As starch boiled in water with sulphuric acid, and thereby changed into sugar increases in weight, without uniting with any sulphuric acid, or gas, or without forming any gas, we are under the necessity of ascribing the change wholly to the *fixation or solidification of water.* Hence we must conclude that *starch sugar is nothing else than a combination of starch with water in a solid state.* The sulphuric acid is not decomposed nor united with the starch as a constituent."

'It appears, likewise, that Capt. Palter, of Sackett's Harbor, at the instance of Samuel Guthrie, of the same place, has succeeded in the manufacture of sugar from the potatoe; and a detail of the process by which this is effected, is given in Professor Silliman's Journal of January, 1832. It is there said that—

"A bushel of potatoes weighs about sixty pounds, and gives eight pounds of pure, fine, dry starch. This amount of starch will make five pints of sugar, of the weight of nearly twelve pounds to the gallon, equal to seven pounds and a half to the bushel of potatoes, or a little less than a pound of sugar to a pound of starch. The sugar is not so sweet as the Muscovado sugar, nor is it actually so sweet as its taste would indicate.

"This sugar may be used for all domestic purposes. It ferments with great liveliness and spirit, when made into beer, yielding a healthful and delicious beverage, and on distillation a fine cider-brandy flavored spirit. It would, however, be most useful in making sweetmeats, and may be used upon the table instead of honey, for which it is a good substitute. It has already become a favorite with most people who have become acquainted with it. Its taste is that of a delicious sweet, and as an article of diet is unquestionably more healthful and less oppressive to the stomach than any other sweet ever used."

'The elements or chemical constituents of starch, and of sugar, are nearly the same. According to Mr. Gay Lussac and Thenard, one hundred parts of starch are composed of

Carbon, with a small quantity of saline and earthy matter,	43.55
Oxygen,	49.68
Hydrogen,	6.77
	100.00
or, Carbon,	43.55
Oxygen and hydrogen in the proportion neces-	

sary to form water, 56.45

'Lavoisier concluded from his experiments that sugar is composed of the following elementary proportions in a hundred parts:—

28 carbon,
8 hydrogen,
64 oxygen.

Then to turn starch to sugar it is merely necessary to subtract from the carbon of the starch, to wit, 43.55, 15.55, and it will stand 28 carbon.

To add to the oxygen of the starch, to wit, 49.68, 14.32, and it is 64 oxygen.

To add to the hydrogen of the starch, to wit, 6.77, 1.23, and it is 8 hydrogen.

Thus, by adding oxygen and hydrogen to starch, in certain proportions, and by subtracting or driving off as much carbon as will be equivalent to the additions, starch is changed to sugar. Water is composed of oxygen and hydrogen, and, together with the sulphuric acid, furnishes the elements necessary for the change, by the agency of the same heat which expels a part of the carbon.

'Should any person still doubt whether water can exist in a solid state, combined with other substances, but not frozen, let him take the trouble to weigh a small quantity of quick lime, then slake it with water, and mark its increase of weight.

'Braconnet, a celebrated chemist, raised vegetables in pure river sand, in litharge, in flowers of sulphur, and even among metal, or common leaden shot; and in every instance nothing was employed for their nourishment but *distilled water*. The plants throve, and passed through all the usual gradations of growth to perfect maturity. The author then proceeded to gather the entire produce, the roots, stems, leaves, pods, *&c*. These were accurately weighed, then submitted to distillation, incineration, lixiviation, and other ordinary means used in careful analysis. Thus he obtained from the vegetables all the materials peculiar to each individual species, precisely as if it had been cultivated in its own natural soil;—viz. the various earths, the alkalies, acids, metals, carbon, sulphur, phosphorus, nitrogen, hydrogen, *&c*. He concludes this important paper with these remarkable words:—"Oxygen and hydrogen, with the assistance of solar light, appear to be the only elementary substances employed in the constitution of the whole universe; and nature in her simple progress, works the most infinitely diversified effects by the slightest modification of the means she employs."

'This chemist entertained an opinion founded on experiment, that the elements of water composed plants, the decay of plants

formed the materials which constitute the earth; and of course the "Great Globe and all which it inherit," so far as natural causes are concerned, are products of the modification and fixation of water. Other philosophers assure us that the remains of marine animals, &c, are found on the highest mountains; and that there are many and incontrovertible proofs that the solid parts of the globe have gained on its waters, not only within the limits of authentic history, but in some cases within the memory of man.'

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. VIII.

ATTEMPTS TO SUBSTITUTE OTHER FOOD FOR MULBERRY LEAVES IN REARING SILKWORMS. 'It must always be a subject of anxious attention with the rearer of silkworms so to time the hatching of his eggs as to cause the coming forth of the living insects at the season when the mulberry tree first comes into leaf.

'By the aid of artificial means, and with methodical arrangements, this would appear to be a very simple affair; and yet, so great have the difficulties been in practice, that various expedients have from time to time been proposed and attempted for combating them.

'Great industry has been employed to seek out some substitute for the natural food of the worm, which should be readily procurable at all seasons, and in sufficient abundance to render the cultivator independent of the chances which attend the budding of the mulberry tree. Dr. Lodovico Bellardi, a learned and ingenious botanist of Turin, after making numerous experiments, and failing to discover any elligible substitute for the mulberry, at length proposed a method of feeding such silkworms as should be prematurely hatched, upon leaves of the preceding season carefully dried and prepared for the purpose. The trials made by the doctor were accompanied by all the success he could desire.

'The leaves which had been gathered in fine weather, towards the close of the preceding autumn, and before any injury from frost could have been experienced, were first spread on cloths and dried in the sun, and then reduced to powder; this was preserved through the winter in a perfectly dry place. Before giving it as food to his newly-hatched brood, the powder was slightly moistened with water, and a thin layer of it being placed around the insects, they immediately and with avidity began to feed, preferring it to every

substitute which was offered, and thriving upon it satisfactorily.

'While the hope still remained of naturalizing the silkworm in England, the means of procuring a sufficient supply of appropriate food, was considered as one of the greatest obstacles to its success; and the attention of such persons as interested themselves in the pursuit was consequently engaged, in ascertaining by experiment whether other leaves than those furnished by the mulberry tree, might not be favorably substituted.

'Among others, the Rev. Mr. Swayne exhibited much anxiety for the success of this object, with the praiseworthy desire of providing profitable employment for such of the poorer classes as might be too feeble for manual labor; most of the duties required in attendance upon the silkworm being such as can easily be fulfilled by women, children, and aged persons.

'This gentleman made various trials as to the relative merits of different kinds of nourishment. For this purpose, he placed equal numbers of newly-hatched worms in three different boxes, which he numbered 1, 2, and 3. The contents of number 1. he fed entirely with leaves of the white mulberry; the insects in number 2. were nourished with those of the black mulberry; and the worms in number 3. were furnished with lettuce leaves until their first age was passed, and thereafter with the black mulberry leaf. These last worms were of a paler color, and grew more rapidly than the others. The result, however, seems to prove that, although lettuce leaves may yield bodily nourishment to the insect, they contribute little towards the secretion of that peculiar matter which constitutes its value. When the spinning had been completed, twelve of the finest cocoons were chosen from each of the three divisions, and were found to be of the following weights:—

Cocoons of	No. 1.	weighed	7 dwts.	2 grains.
Ditto -	No. 2.	-	6	-	3
Ditto -	No. 3.	-	6	-	0

None of these results were very encouraging to the cultivator, but the experiment clearly evinced the superiority of the white mulberry over the other kinds of nourishment.

'Many communications upon this subject are to be found in the volumes recording the Transactions of the Society for the Encouragement of Arts, &c. A letter from Miss Rhodes relates, that in the summer of 1785, she subsisted several thousand worms entirely on lettuce leaves during three weeks, and that for the remaining short term of their lives, she afforded them their natural food. At the end of a month from their first hatching, they began to spin, and eleven ounces of silk were procured from four thousand cocoons. After repeated trials, this lady had become convinced that

silkworms could not safely be fed on lettuce leaves for a longer period than three weeks; as on persisting further in their use, the greater part of the worms died without forming their cocoons. Some, indeed, possessed sufficient vigor to spin and to produce perfect and well-formed balls, even when lettuce leaves had constituted their only food. Reasoning from this fact, Miss Rhodes was brought to suspect that the premature mortality of her brood was not altogether occasioned by the unwholesome nature of the aliment on which they had fed, but might be owing to some extraneous circumstance; and further observation led her to the conclusion that it was the coldness of the lettuce leaves rather than any inherent property which made them detrimental. This lady having thence suggested that if the worms were kept in a higher temperature, they might be successfully supported through their lives on lettuce leaves; general Mordaunt caused a considerable number to be hatched and reared in his hot house. These were fed entirely on lettuce leaves; they throve and went through all their mutations as satisfactorily as if fed with their natural nourishment; scarcely any among them died, and the number and quality of the cocoons that were gathered proved the entire success of the experiment. If a solitary trial be sufficient to establish a fact, this must certainly be satisfactory to those who consider it desirable to naturalize silkworms in England, where, owing to the inequality of seasons, the appearance of mulberry leaves must always be uncertain in regard to time. Lettuce leaves have an advantage over other vegetables which have been offered as substitutes for the mulberry, that they may be gathered in wet weather without themselves being wetted, as a lettuce, once cabbaged, resists the entrance of all moisture within; and the heart being always perfectly dry, ensures nourishment to the worm, free from that moisture which is always found to affect it injuriously.

'Mrs. Williams, an earlier correspondent of the society whose "Transactions" have been quoted, gives a very minute and copious account of the various trials which she made of vegetable substances as substitutes for mulberry leaves. Having hatched her brood in severely cold weather, when even lettuces were not easily procurable, she offered to her worms the tender parts of blackberry leaves, and relates that the worms ate them greedily. She next presented to them young leaves of the elm, and reports that equal success attended this trial: encouraged by these facts, she then succeeded in causing the insects to feed on the leaves and flowers of the sweet cowslip and primrose. But meanwhile the mulberry had put forth its leaves, and having procured some of these for her brood, it was thenceforth vain to offer them any oth-

er kinds of food: all were rejected; and another proof was afforded, that the mulberry tree, which no other insect will attack, is alone adapted to the natural desires of the silkworm. Mrs. Williams records one peculiarity which discovered itself throughout her investigation; by no means could the worms be brought to touch any flower of roseate hue. Pinks, roses, sweet williams, polyanthoses, were each in turn offered by this persevering lady, and were all rejected without hesitation. It is proper to remark, that these experiments of Mrs. Williams are not confirmed by those of any other person, but, on the contrary, that Miss Rhodes was unsuccessful in every endeavor to repeat them, and succeeded only in reconciling her silkworms to the use of lettuce and spinach.

'Attempts to discover a substitute for the mulberry are not entirely abandoned even at the present time. It is recorded in the Bulletin Universel, for 1829, that Madamoiselle Coge of Epinal, has used with success the leaves of the scorzonera (viper grass) for the nourishment of silkworms. The silk produced by worms fed on this leaf, is represented to be in no respect inferior to that from worms kept on the natural food.

'Notwithstanding, however, this last announcement, and the partial success so frequently recorded as attending the substitution of the lettuce, all practical cultivators of silk continue to be convinced that it would be unprofitable to feed their worms on any save their natural nourishment; and the most intelligent writers on the subject, approve the practice of destroying, as useless, any worms, which through ill management may be hatched before the mulberry tree has put forth leaves sufficient for their support.

'Recent attempts which have been made to rear silkworms in England, do not offer much encouragement to the pursuit, except as matter of amusement. Some pairs of silk stockings of good quality are to be seen in the gallery of "The National Repository," woven from silk of home production. The worms which spun this were reared by Mrs. Allen of Wandsworth, the result of whose careful observations on this subject has been obtained.

'The difficulty of procuring a sufficient and continuous supply of proper food was the reason why this lady was obliged to relinquish a pursuit in which she had taken much pleasure for four successive years.

'Mrs. Allen's testimony strongly corroborates the necessity of extreme cleanliness in preserving the health of the worms. The most scrupulous attention seems to have been paid by her to this particular, as well as to the dryness of the leaves, and the temperature of the apartment wherein the insects were reared and set to spin; and yet a very great mortality was always experienced

among them, scarcely more than one in five of the worms that were hatched coming to maturity and forming their cocoons. Of these it required one thousand to furnish an ounce of reeled silk, the floss being equal to a quarter of an ounce more. The cocoons were gathered in eight days from their commencement, and in eight days more were wound off. No necessity hence arose for destroying the vitality of the insects to prevent their piercing the balls. The chrysalides being placed in bran, in due time became moths and produced eggs, each female furnishing between three and four hundred.'

THE WHITE PINE.

Pinus strobus.

Fig. 1. A leaf. Fig. 2. A cone. Fig. 3. A seed.

This species, one of the most interesting of the American pines, is known in Canada and the United States by the name of *White Pine*, from the perfect whiteness of its wood when freshly exposed; and in New Hampshire and Maine by the secondary denominations of *Pumpkin Pine*, *Apple Pine*, and *Sapling Pine*, which are derived from certain accidental peculiarities. This tree is diffused, though not uniformly, over a vast extent of country; it is incapable of supporting intense cold, and still less extreme heat. It is first observed in the north about forty leagues from the mouth of the river Mistassin, which discharges itself into Lake St. John in Canada, in the latitude of 48° 50′. It appears to be most abundant between the 43d and 47th degrees of latitude; farther south it is found in the valleys and on the declivities of the Alleghanies to their termination, but at a distance from the mountains on either side, its growth is forbidden by the warmth of the climate. It is said with great probability to be multiplied near the

source of the Mississippi, which is in the same latitude with the state of Maine, the upper part of New Hampshire, Vermont, and the commencement of the St. Lawrence, where it attains its greatest dimensions. In these countries it is seen in very different situations, and it seems to accommodate itself to all varieties of soil except such as consist wholly of sand, and such as are almost wholly submerged. The largest stocks are found in the bottom of soft, pliable and fertile valleys, on the banks of rivers composed of deep, cool, black sand, and in swamps covered with a thick and constantly humid carpet of *sphagnum.*

Near Norridgewock on the river Kennebeck, in one of the swamps, which is accessible only in midsummer, M. Michaux measured two trunks felled for canoes, of which one was one hundred and fifty-four feet long and fifty-four inches in diameter, and the other one hundred and forty-two feet long, and forty-four inches in diameter, at three feet from the ground. Mention is made in Belknap's History of New Hampshire, of a white pine felled near the river Merrimack, seven feet eight inches in diameter. M. Michaux likewise measured a stump near Hallowell, Maine, exceeding six feet in diameter: these enormous trees had probably reached the greatest height attained by the species, which is about one hundred and eighty feet. But this ancient and majestic inhabitant of the North American forests, is still the loftiest and most valuable of their productions, and its summit is seen at an immense distance aspiring towards heaven, far above the heads of the surrounding trees. The trunk is simple for two-thirds or three fourths of its height, and the limbs are short and verticillate, or disposed in stages one above another to the top of the trees, which is formed of three or four upright branches seemingly detached and unsupported. In forests composed of other trees, where the soil is strong and proper for the culture of corn, as for example on the shores of Lake Champlain, it is arrested at a lower height and diffused into a spacious summit; but it is still taller and more vigorous than the neighboring trees. On young stocks, not exceeding forty feet in height, the bark of the trunk and branches is smooth and even polished; as the tree advances in age it splits and becomes rugged and gray, but does not fall off in scales like that of the other pines. The white pine is also distinguished by the sensible diminution of its trunk from the base to the summit, in consequence of which, it is more difficult to procure sticks of great length and uniform diameter: this disadvantage, however, is compensated by its bulk and by the small proportion of alburnum. The leaves are five-fold, four inches long, numerous, slender, and of a bluish green: to the lightness and delicacy of the foliage is

owing the elegant appearance of the young trees. The male aments are four or five lines long, united to the number of five or six, and arranged like those of the loblolly and long-leaved pines: they bloom in the month of May, and turn reddish before they are cast: the cones are four or five inches long, ten lines in diameter in the middle, pedunculated, pendulous, somewhat arched, and composed of thin, smooth scales, rounded at the base. They open about the first of October, to release their seeds, of which a part are left adhering to the turpentine that exudes from the scales.

The wood of this species is employed in greater quantities and far more diversified uses than any other American pine; yet it is not without essential defects; it has little strength, gives a feeble hold to nails and sometimes swells by the humidity of the atmosphere. These properties are compensated however by others which give it a decided superiority; it is soft, light, free of knots, and easily wrought, is more durable, and less liable to split when exposed to the sun, furnishes boards of a great width, and timber of large dimensions, in fine, it is still abundant and cheap. It is observed that the influence of soil is greater upon resinous than upon leafy trees. The qualities of the white pine, in particular, are strikingly affected by it. In loose, deep, humid soils, it unites in the highest degree all the valuable properties by which it is characterized, especially lightness and firmness of texture, so that it may be smoothly cut in every direction; hence the name *Pumpkin Pine*. On dry, elevated lands, its wood is firmer and more resinous, with a coarser grain and more distant concentric circles, and it is then called *Sapling Pine*. The wood of this tree is used for every species of ornamental work about building, for *clap boards*, and shingles, for looking glass and picture frames, for images in sculpture, the inside of mahogany furniture and of trunks, in cooperage and an endless variety of other purposes. It serves exclusively for the masts of the numerous vessels constructed in the Northern and Middle States. The principal superiority of these masts over those exported to England from Riga is their lightness; but they have less strength, and are said to decay more rapidly between decks and at the point of intersection of the yards: this renders the long-leaved pine superior to the white pine in the opinion of the greater part of American ship builders. The bowsprits and yards are also made of white pine. The wood is not resinous enough to furnish turpentine for commerce, nor would the labor of extracting it be easy, since this tree occupies exclusively, tracts of only a few hundred acres, and is usually mingled in different proportions with the leafy tree. *Sylva Americana.*

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR JUNE, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Inches.
1	70	91	80	30.08	30.08	30.05	Fair	Fair	Fair	S. W.	N. W.	N. W.	
2	72	82	67	30.05	30.07	30.07	Fair	Fair	Fair	N. W.	E.	N. E.	
3	63	70	68	30.07	30.00	29.95	Cloudy	Fair	Fair	E.	E.	S. W.	
4	66	81	70	29.94	29.94	29.97	Fair	Fair	Fair	E.	S. W.	S. W.	
5	68	82	72	29.97	29.98	29.99	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
6	68	78	68	30.00	30.09	30.09	Cloudy	Cloudy	Fair	S. E.	S. W.	E.	
7	62	68	60	30.10	30.12	30.10	Cloudy	Fair	Fair	N. E.	N. E.	E.	
8	58	69	68	30.10	30.10	30.10	Fair	Fair	Fair	E.	E.	S. W.	
9	58	80	66	30.11	30.11	30.14	Fair	Fair	Fair	N. W.	S. W.	S. W.	
10	63	85	74	30.14	30.15	30.12	Fair	Fair	Fair	S. W.	S. W.	S. W.	
11	70	75	71	30.12	30.12	30.07	Fair	Fair	Fair	S. W.	E.	S. W.	
12	69	89	74	30.04	30.02	30.01	Fair	Fair	Fair	S. W.	S. W.	S. W.	
13	70	88	73	30.00	30.03	30.04	Fair	Fair	Fair	S. W.	S. W.	S. W.	
14	70	76	67	30.04	30.06	30.05	Cloudy	Cloudy	Rain	S. W.	E.	N. W.	
15	67	64	60	30.07	30.12	30.10	Cloudy	Rain	Rain	N.	N. E.	N. E.	.42
16	59	64	60	30.12	30.15	30.15	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.	1.14
17	60	73	66	30.05	30.04	29.98	Rain	Fair	Fair	N. E.	N. W.	S. E.	.35
18	67	82	76	29.99	30.00	30.00	Fair	Fair	Fair	S. W.	E.	S. W.	
19	73	82	71	30.00	30.00	30.00	Fair	Cloudy	Fair	S. W.	S. W.	N. W.	.16
20	70	84	76	30.00	30.00	30.00	Fair	Fair	Fair	N. W.	N. W.	S. W.	
21	74	76	73	29.95	29.87	29.83	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	.58
22	66	76	68	29.94	29.99	30.04	Fair	Fair	Fair	N. W.	N. W.	N. W.	
23	60	55	53	30.10	30.10	30.15	Rain	Rain	Fair	N. E.	N. E.	N. E.	.73
24	43	49	56	30.24	30.28	30.28	Fair	Fair	Fair	N. W.	E.	N. W.	
25	52	66	59	30.28	30.20	30.18	Fair	Fair	Fair	N. W.	E.	S. W.	
26	53	66	62	30.15	30.22	30.30	Fair	Fair	Fair	N. W.	E.	E.	
27	61	72	66	30.31	30.30	30.,20	Fair	Cloudy	Fair	S. W.	S.	S. W.	
28	66	73	72	30.08	30.00	29.38	Fair	Cloudy	Rain	S. W.	S. W.	S. W.	
29	69	74	70	29.94	29.92	29.93	Cloudy	Cloudy	Fair	S. W.	S. W.	S. W.	.20
30	66	72	65	30.04	30.12	30.20	Fair	Fair	Rain	N. W.	E.	N. E.	

Depth of rain fallen 3.58 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

Pendleton's Lithog.y Boston

NAMES OF

PHRENOLOGICAL ORGANS

referring to the figures indicating their

RELATIVE POSITION.

I. Propensities.

1 *Amativeness*
2 *Philoprogenitiveness*
3 *Concentrativeness*
4 *Adhesiveness*
5 *Combativeness*
6 *Destructiveness*
7 *Constructiveness*
8 *Acquisitiveness*
9 *Secretiveness.*

II. Sentiments.

10 *Self esteem*
11 *Love of approbation*
12 *Cautiousness*
13 *Benevolence*
14 *Veneration.*
15 *Hope*
16 *Ideality — Wonder*
17 *Conscientiousness*
18 *Firmness.*

III. Intellect.

19 *Individuality* } *or higher* } *or lower*
20 *Form*
21 *Size*
22 *Weight*
23 *Coloring*
24 *Locality*
25 *Order*
26 *Time*
27 *Number*
28 *Tune*
29 *Language*
30 *Comparison*
31 *Causality*
32 *Wit*
33 *Imitation.*

THE NATURALIST.

SEPTEMBER, 1832.

PHRENOLOGY.

[As there is a considerable agitation at the present period respecting phrenology, we trust that many of our readers are desirous to know something of the subject, who, nevertheless, are not prepared to bestow much, either of time or of money in the pursuit of it. We have accordingly furnished them with the following article, the principal part of which, may be found in that excellent work, the Encyclopædia Americana. The reader will be pleased to consider it as in no way implicating our sentiments, but merely a true representation of the science as advanced by its advocates. We do not feel competent to decide on the accuracy and completeness of the mental and cerebral survey executed by Messrs. Gall and Spurzheim, nor profess to judge of the exactness and fidelity with which the numerous positions are marked down in their very complete and well-filled map of the brain. They appeal to observation for the confirmation or refutation of their statements; but our observations are not numerous or varied enough for these purposes. No one can refuse to them the merit of patient inquiry, careful observation, and unprejudiced reflection. They have performed the useful service of rescuing us from the trammels of doctrines and authorities, and directing our attention to nature, whose instructions cannot deceive us. Whether the views of Gall and Spurzheim may be verified or not, our labors in this direction must be productive, and must bring with them many collateral advantages. Although we are not desirous to make our pages the *arena* of controversy, if any one wishes to refute or confirm their views, we will most cheerfully act on the equitable principle of *audi alteram partem.*]

'Phrenology (from *phren*, mind, and *logos*, science); also called *craniology*; the doctrine first systematically exhibited by doctor Gall, of the formation and functions of the nervous system, and particularly of that portion of it which is enclosed in the skull,

and composes what is called the ***brain***: hence the name ***craniology***, from ***kranion***, the skull, and ***logos***, science. To give another definition, "phrenology treats of the faculties of the human mind, and of the organs by means of which they manifest themselves; but it does not enable us to predict actions." The origin of this branch of physiology, has been touched upon in the account of its author. He published his observations in a work entitled ***Anatomie et Physiologie du Systeme nerveux en general et du Cerveau en particulier*** (Paris, 1801 et seq., 4to.), and illustrated them by numerous engravings in folio. The chief points of his doctrine are the following. The brain is that organ of the body by which the mind of man exerts its activity. It is, however, not active in all its parts in every act of thinking; but, as every sense, every organ of motion, and, in general, every function of the body, has a particular nerve, or set of nerves, as its instrument, so every operation of the mind essentially different from the others has a separate part of the brain for its organ, which is indispensable to it. The strength and size of the nerve, are in proportion to the power of action belonging to this organ. The nerve of the trunk of the elephant has the strength of a child's arm. Man's brain is more complex than that of any other member of the whole animal creation. It not only unites all those organs which are found singly in the brains of other animals, but has also others which are not found in them. The skulls of men exhibit great varieties, as well in the quantity of the brain, as in the elevation of certain points; and observation teaches that the better sort of heads are distinguished, if not by a greater circumference of the whole skull, yet by the prominence of peculiar elevations, that is, by a greater mass of brain at those points. In youth, the period of developement, and the time of the formation of the dispositions, the whole brain has a tendency towards expansion. If the upper part of a young skull is taken off, the brain forces itself out, and cannot be pressed back into the same space by replacing the part of the skull: with an old skull, precisely the contrary is observable. The functions of certain parts of the brain are different from each other, and independent of each other, and those parts of the skull which cover them, are distinguished by peculiar forms. The brain is a convolution of organs. The point of union of all the nerves must be considered to be where the spinal marrow and the brain join in the neck at a spot, by pressure on which any animal possessing a brain is easily killed. Part of the nervous substance descends as spinal marrow, gives out nerves to all the organs of the body, and is distributed at last entirely into nervous ramifications. The second part ascends into the cavity of the

skull, gives out branches to the cerebellum, and diffuses itself in the forms of rays, through the whole mass of the cerebrum, or rather composes it, leaving, however, in four places empty spaces (the ventricles). The variety of functions is expressed by an equally great variety in form and color. The organs of the brain are double. The whole mass of brain may be divided into two equal hemispheres, and singleness takes place only where those organs are supposed to exist, which seem to be destined to unite all the activities in a common consciousness: hence, if an organ in one part is deficient, the other part may still be active; so that the function belonging to them may still be performed; as one kidney may be wanting without a total suppression of the secretion of urine. Those organs which are found in all animals provided with a brain, (such as have the most immediate connexion with the maintainance of the vital energy), are situated towards the base of the skull; but, when the brain becomes nobler by the addition of organs of more elevated faculties, these additional organs are found towards the upper and outer parts of the skull. In a similar way, the increase of some parts of the brain shows itself by prominence beyond the others. The skull itself is in a passive state, that is, its form is determined, by the surface of the brain, and does not press on the brain, if in a healthy or natural condition; for the brain exists even in the fœtus, before the formation of the skull. It is then only surrounded by the hard membrane called the *dura mater*, which has to form and to nourish the skull. The bones of the skull consist, in adults, of two laminæ, between which lies a marrowy *diploe*. Nevertheless, the two laminæ are every where parallel with each other, except at a few points. Accurate and continued observation and comparison of men, says the phrenologist, have shown that particular elevations of the skull allow us to infer a great developement of the dispositions or faculties belonging to the organs under these protuberances, but that, where all the functions are developed harmoniously (as in Wieland's head), the skull forms no abrupt elevations, but an even arch. The observation of men in different situations, and with peculiar dispositions and faculties, and of the skulls of such individuals, anatomico-physiological investigations of the brain, and particularly comparative anatomy, with particular reference to the disposition or faculty by which particular animals are distinguished, and to the peculiar character of their skulls; pathological observations of persons suffering in the brain or the mind, as of cretins, idiots, insane persons, or persons whose brains have been injured by external violence, experiments with animals (not unfrequently cruel ones), by wounding or destroying certain parts

of the brain, *&c.*, furnish the facts on which phrenology rests. By means of such observations, Gall considered that he had found the parts of the brain belonging to several faculties and dispositions. These, as far as they can be discovered by observation of the exterior of the skull, are, of course, only such as are situated towards the surface of the brain: a number of others, situated deeper, and towards the centre, may, indeed, be conjectured at present, but can only be ascertained by continued study. Whatever may be the opinion respecting phrenology, it is certain that the observations of Gall, and other phrenologists, are highly remarkable; and Gall's idea is not, as some have asserted, immoral, and founded on materialism. From times immemorial, it has been known that men are born, not only with different faculties of intellect, but also with different moral dispositions, which is true both of single individuals, and of whole nations, and the phrenologist only strives to find the organic cause of these differences, which is as innocent as to ascribe peculiar dispositions to the influence of climate. The phrenologist does not say that these dispositions cannot be overcome; but who does not know that moral efforts are much more difficult to some persons than to others? The individual organs, according to the classification nomenclature of doctor Spurzheim's New Physiognomical System, published in 1815, are as follows. A faculty is admitted as primitive if it exists in one kind of animal and not in another; varies in the two sexes of the same species; is not proportionate to the other faculties of the same individual; does not manifest itself simultaneously with the other faculties (appears and disappears earlier or later in life than other faculties); may act, or rest singly; may singly preserve its proper state of health or disease. The organs are divided into those of the *propensities*, the *sentiments*, and the *intellect.*'

I. Propensities.

The faculties falling under this genus, do not form ideas; their sole function is to produce a propensity of a specific kind. These faculties are common both to man and other animals.

1. *Amativeness.* The cerebellum is the organ of this propensity, and it is situated between the mastoid process on each side, and the projecting point in the middle of the transverse ridge of the occipital bone.* The size is indicated during life by the thickness of the neck at these parts. In new-born children the cerebellum is the least developed of all the cerebral parts. It is, to the brain, as one to thirteen, fifteen, or twenty, and in adults

* For illustration of these, see Plate ix.

as one to six, seven, or eight. It attains its full size from eighteen to twenty-six. It is less in females, in general, than in males. In old age it frequently diminishes.

2. *Philoprogenitiveness.* This organ is situated immediately above the middle part of the cerebellum, and corresponds to the protuberance of the occiput. It is generally longer in females than in males. When it is large, it gives a drooping appearance to the hind part of the head. The chief function of the faculty is to produce the instinctive love of offspring in general. This feeling is distinct from benevolence; for we frequently find it strong in selfish individuals, who manifest no compassionate feeling towards adults. It is generally distinct from self-love, for sometimes the most generous are passionately fond of children, and occasionally the most selfish are indifferent about them.

3. *Concentrativeness.* This organ is situated immediately above the one last named, and below self-esteem. It was first called by Spurzheim, *inhabitativeness*, as it was found in persons and other animals much attached to one place; but now it is believed that its function is to maintain two or more powers in simultaneous and combined activity.

4. *Adhesiveness.* This organ is located on each side of concentrativeness, higher up than philoprogenitiveness, and just above the lambdoidal suture. It produces an instinctive tendency to attach one's self to surrounding objects, animate and inanimate. Those persons in whom it is very strong, feel an involuntary impulse to embrace and cling to the object of their affections. It disposes to friendship and society in general, and gives ardor to the shake of the hand. In boys, it frequently indicates itself by attachment to dogs, horses, birds, etc. In girls it shows itself by affectionate embraces of the doll. It is stronger, and the organ is larger, in women than in men. When too strong, it causes excessive regret at the loss of a friend, or excessive uneasiness at leaving one's country.

5. *Combativeness.* This organ is situated at the inferior and mastoid angle of the parietal bone. It produces active courage, and when energetic, the propensity to attack. A considerable endowment is indispensable to all great and magnanimous characters. It gives that boldness to the mind, which enables it to look undaunted on opposition, to meet, and, if possible, to overcome it. When very deficient, the individual cannot resist attacks, and is incapable of making his way when he must invade the prejudices or encounter the hostilities of others. When too energetic, it inspires with the love of contention for its own sake; leads to a fiery and quarrelsome disposition; and pleasure may then be felt in disputation or in fighting.

6. *Destructiveness.* This organ is situated immediately above, and extends a little backwards and forwards from the external opening of the ear, and corresponds to the squamous plate of the temporal bone. The faculty produces the impulse, attended with desire to destroy in general. It prompts us to exterminate obstacles, so that they may never rise up to occasion fresh embarrassment. When energetic, it gives a keen and impatient tone to the mind, and adds activity and force to the whole character. Anger and rage are manifestations of it, which being analyzed, are threats of unpleasant consequences, or, vengeance to those who transgress our commands, or encroach on our rights. Hence, it gives weight to injunction, by inspiring with dread of suffering in case of disobedience. It is essential to satire; and inspires authors to write cuttingly, with a view to lacerate the feelings of their opponents. When very deficient, there is a lack of fire in the constitution; the mind, as it were, wants edge, and the individual is prone to sink into passive indolence. The organ is conspicuous in the heads of cool, deliberate murderers, and in persons habitually delighting in cruelty; it is likewise prominent, in the head of the sportsman, and prompts him to bear with cheerfulness the fatigues of hunting, with the uncertainty of capture. It is also generally large in those who are fond of seeing public executions, floggings, and the infliction of pain in all its forms.

7. *Constructiveness.* This organ is situated at that part of the frontal bone immediately above the spheno-temporal suture. In man, the faculty inspires with the tendency to construct in general, and the particular direction in which it is exerted, depends on the other predominant faculties of the individual; for example, if combined with large combativeness and destructiveness, it may be employed in fabricating implements of war; if joined with veneration predominating, it may tend towards erecting places of religious worship. If united with large form, imitation, and secretiveness, it may inspire with a love of portrait painting. In the lower order of animals, it appears to be directed, in a great measure, to one special object; in a bird, to a particular form of nest, in the beaver, to a special fashion of hut; in the bee, to an unerring form of cell,—these animals being deficient in the generalizing and directing powers conferred on men. The organ is indispensable to all who follow operative mechanical professions.

8. *Acquisitiveness.* This organ is situated at the anterior inferior angle of the parietal bone. Spurzheim first called it *covetiveness.* The faculty produces the tendency to acquire, and the desire to possess in general, without reference to the uses to which the objects, when obtained, may be applied. The idea of prop-

erty is founded on it. It takes its direction from other faculties, and hence, may lead to collecting coins, paintings, minerals, and other objects of curiosity and science, as well as money. Idiots, under its influence, are known to collect things of no intrinsic value. This instinctive tendency to acquire and to accumulate, is the foundation of wealth, and of the conveniences and luxuries of civilized society.

9. *Secretiveness.* This organ is situated at the inferior edge of the parietal bones, immediately above destructiveness, or in the middle of the lateral portion of the brain. This faculty produces instinctive tendency to conceal spontaneous thoughts, emotions, etc., from outward expression, until the understanding shall have decided on their propriety and probable consequences. Besides, man and other animals are occasionally liable to the assaults of enemies, which may be avoided by concealment, in cases where strength is wanting to repel them by force. Nature, therefore, by means of this propensity, enables them to act with prudence, slyness, or cunning, according to the dictates of the other faculties possessed by the individual, to their other means of defence. The organ has been found large in actors, and in those who excel in the imitative arts.

II. Sentiments.

These faculties, like those which we have already considered, do not form specific ideas, but produce merely a *sentiment*; that is, a propensity, connected with an emotion, or feeling of a certain kind. Several of them are common to man and the lower animals; others are peculiar to man.

Sentiments common to man and other animals.

10. *Self-Esteem.* This organ is situated at the vertex or top of the head, a little above the posterior or sagittal angle of the parietal bones. This faculty produces the sentiment of self-esteem or self-love in general. If modified by other organs, it is the source of great good. The lower animals, such as the turkey-cock, peacock, horse, etc., manifest feelings resembling pride or self-esteem. Nations differ in regard to the degree of this sentiment. The English have more of it than the French, and hence the manner of a genuine Englishman appears to a Frenchman, cold, haughty, and supercilious. When the organ becomes excited by disease, the individual is prone to imagine himself a king, emperor, or a transcendant genius, and some have fancied themselves even the Supreme Being.

11. *Love of Approbation.* This organ is situated on each side of that of self-esteem and commences about half an inch from the

lambdoidal suture. The faculty produces the love of the esteem of others, expressed in praise or approbation. A due endowment of it is indispensable to an amiable character. It induces its possessor to make active exertions to please others, and also to suppress numberless little manifestations of selfishness, and to restrain many peculiarities of temper and disposition, from the dread of incurring their disapprobation. It is the butt upon which wit strikes, when, by means of ridicule, it drives us from our follies. To be laughed at, is worse than death to a person in whom this sentiment is predominant. The direction in which gratification will be sought, depends on the other faculties with which it is combined in the individual. If the moral sentiments and intellect be vigorous, it will desire an honorable fame, and hence animates and excites the poet, painter, orator, warrior, and statesman. When too energetic, and not regulated by the higher powers, it produces great abuses; it then gives rise to a fidgety anxiety about what others will think of us, which is at once subversive of happiness and independence. It renders the mere *dicta* of the society in which the individual moves, his code of morality, religion, taste, and philosophy; and incapacitates him from upholding truth or virtue, if disowned by those whom he imagines influential or genteel. It then overwhelms the artist, author, or public speaker with misery, if a rival is praised in the journals in higher terms than himself. A lady is then tormented at perceiving, in the possession of her acquaintance, finer dresses or equipages than her own. It excites the individual to talk much of himself, his affairs, and connexions, so as to communicate to the auditor vast ideas of his greatness or goodness; in short, vanity is one form of its abuse. This organ is very powerful in some of the lower order of animals, as the dog, horse, etc.

12. *Cautiousness.* This organ is situated near the middle of each parietal bone, where the ossification of the bone generally commences. The faculty produces the emotion of fear in general, and prompts its possessor to take care, and hence it is named *cautiousness.* A due degree of it is essential to a prudent character. The tendency of it is, to make the individual in whom it is strong, hesitate before he acts, and, from apprehending danger, to trace consequences, that he may be assured of his safety. A great and involuntary, but momentary activity of it, occasions a *panic*, a state in which the mind is hurried away by an irresistible emotion of fear, disproportioned to the outward occasion. The organs are generally largely developed in children; and, in some instances, are so prominent, as to alarm mothers with the fear of disease or deformity. Such children may be safely trusted to

take care of themselves; they will be rarely found in danger. Many of the lower animals, as the hare, rook, etc., possess the organ largely developed.

13. *Benevolence.* This organ is situated at the upper part of the frontal bone, in the coronal aspect, and immediately before the fontanel. The faculty produces the desire of the happiness of others, and disposes to compassion and active benevolence. It communicates mildness and cheerfulness to the temper, and disposes the possessor to view charitably the actions and characters of others. The lower animals possess this organ, but the faculty in them seems to be limited, in a great degree, to the production of passive mildness of disposition. Dogs, horses, monkeys, etc., which have the corresponding part of the forehead large and elevated, are mild and pacific; those on the other hand, in which it is small and depressed, are ill-natured. It is depressed in all the ferocious tribes of animals, and also in nations remarkable for cruelty.

Sentiments Proper to Man.

14. *Veneration.* This organ is situated at the middle of the coronal aspect of the brain, at the bregma or fontanel of anatomists. The faculty produces the sentiment of respect and reverence; and when directed to the Supreme Being, leads to adoration. It predisposes to religious feeling, without determining the manner in which it ought to be directed; so that if the understanding be very unenlightened, it may be gratified with the worship even of images or idols. It is the source also of the tendency to look up to, and admire superiors in rank and power; and, in this way, disposes to obedience. It gives rise to the profound emotions of respect experienced by many, when looking on the ruins of a palace or temple, the graves of their forefathers, or the former habitations of men eminent for genius or virtue. It enters largely into the constitution of a devoted antiquary. It is also the chief element in filial piety.

15. *Hope.* This organ is situated on each side of that of veneration, and extends under part of the frontal and part of the parietal bones. The faculty produces the sentiment of hope, in general, or the tendency to believe in the possibility of what the other faculties desire, but without giving the conviction of it, which depends upon reflection. It inspires with gay, fascinating, and delightful emotions, painting futurity fair and smiling as the regions of primeval bliss. It gilds and adorns every prospect with shades of enchanting excellence; while cautiousness hangs clouds and mists over distinct objects, seen by the mind's eye.

When too energetic and predominant, it disposes to credulity, and, in mercantile men, leads to rash and inconsiderate speculation.

16. *Ideality.* This organ is situated nearly along the lower edge of the temporal ridge of the frontal bone. The faculty produces the feeling of exquisiteness and perfectibility, and delights in the *beau ideal.* The knowing and reflecting faculties perceive qualities as they exist in nature; but this faculty desires something more exquisitely lovely, perfect, and admirable, than the scenes of reality. It tends to elevate and endow with splendid excellence every object conceived by the mind; and stimulates the other faculties to create scenes and objects invested with the qualities which it delights to contemplate, rather than with the degree of perfection which nature usually bestows. It is the faculty which inspires with exaggeration and enthusiasm, which prompts to embellishment, and splendid conceptions. It is essential to the poet, painter, sculptor, and all who cultivate the fine arts.

Wonder. Immediately above ideality, a blank space appears in the busts and plates of the head; the function of this part of the brain was not ascertained when the other organs were numbered, and it was therefore unmarked. Dr. Spurzheim states that the faculty connected with this organ, produces the tendency to believe in inspirations, presentiments, phantoms, etc.

17. *Conscientiousness.* This organ is situated on the posterior and lateral parts of the coronel surface of the brain, upwards from cautiousness, and backwards of hope. The faculty produces the feeling of obligation, incumbency, right and wrong.

18. *Firmness.* This organ is situated at the posterior part of the coronel surface of the head, close upon the middle line. It is difficult to analyze and distinguish the ultimate principle of the faculty. Its effects are sometimes mistaken for *will*; because those in whom it is large are prone to use the phrase 'I will,' with great emphasis, which is the natural language of determination; but this sentiment is different from proper volition. It produces determination, constancy, and perseverance. Fortitude, as distinguished from active courage, results from it. When powerful, it gives a fixed, forcible, and emphatic manner to the gait, and a corresponding tone to the voice. It is indispensable to the attainment of excellence in any difficult department of art, science, or business. It gives, however, perseverance only in manifesting the faculties which are possessed by the individual in adequate strength.

III. Intellect.

These faculties communicate to man and other animals, knowl-

edge of their own internal sensations, and also of the external world; and their object is to know existence, and to perceive qualities and relations. They consist of the *five senses*, which convey the impressions to the various organs, the province of which is, to form ideas of such qualities; *those powers which take cognizance of external objects*, called the *knowing faculties*, the object of which is attended with a sensation of pleasure; and the *faculties which trace abstract relations, and reason, or reflect*; which produce ideas of reason and reflection.

19. *Individuality.* This organ is situated in the middle of the lower part of the forehead. Two places are marked with the same number, 1-19 and 2-19. The faculty gives the desire, accompanied with the ability, to know facts and things, without determining the kind of knowledge, and without any view to the purposes to which it may be subservient. Its organ is early and largely developed in children, and the faculty is strongly developed by them. It is of importance, not only in philosophy, but in the affairs of life. It prompts to observation, and to investigation by experiment; and is a great element in a genius for those sciences which consist in a knowledge of specific existences. It greatly aids in producing a talent for all practical business involving details, and hence to the medical practitioner, the lawyer, and the merchant, it is of essential advantage. To the orator or the author, it communicates that power of observation which enables him to seize objects and incidents presented to his mind, to store them up, and to recall and apply them, when required, so as to give substance to his mental productions. This organ is possessed by the lower animals. Dr. Gall considers the faculty in them to produce the capacity for education, and he gives a scale of the heads of animals, from the crocodile and frog to the elephant, with the view of proving, that the more this part of the brain is developed in each species, the higher are its susceptibilities of being tamed and taught.

20. *Form.* The size of this organ is indicated by the distance between the eyes; the different degrees of which correspond to the greater or less developement of the portions of brain situated on the mesial or inner side of the orbitary plates of the frontal bone, on each side of the *crista galla.* The function of the organ is to judge of form. It aids the mineralogist, the portrait painter, and all persons engaged in the imitative arts. It gives the power also of distinguishing faces.

21. *Size.* Persons are found who have an intuitive facility in estimating size, and in whom the powers of distinguishing form and relative position are not equally strong; and the part of the

brain under No. 21., has been observed in such individuals to be large. It gives the power of perceiving and judging of perspective. Some officers in the army, in forming their companies into lines, estimate the space which the men will occupy, with perfect accuracy, and others can never learn to judge correctly of this requisite; and the organ has been observed largely developed in the former. Locality also may conduce to this talent.

22. *Weight or Resistance.* There seems to be no analogy between the weight or resistance of bodies, and their other qualities. They may be of all forms, sizes, and colors, liquid or solid, and yet none of these features would necessarily imply, that one was heavier than the other. This quality, therefore, being distinct from all others, we cannot logically refer the cognizance of it to any of the faculties of the mind, which judge of the other attributes of matter; and, as the mental power undoubtedly exists, there appears reason to conjecture, that it may be manifested by means of a special organ. Persons who excel in archery and quoits, also those who find great facility in judging of momentum, and resistance in mechanics, one observed to possess the parts of the brain lying nearest to the organ of size largely developed.

23. *Coloring.* Several of the metaphysicians were aware, that a person may have very acute vision, and yet be destitute of the power of distinguishing colors; but habit and attention have, as usual, been adduced to solve the difficulty. Observation shows, that those who have a great natural power of perceiving colors, have a large developement of that portion of the brain situated under the middle of the arch of the eyebrows, enclosed by the lines 23; while those who cannot distinguish minute shades of color, have this portion small. A large endowment of this faculty renders the sight of flowers and enamelled meadows pleasing. It aids the flower painter, enameller, dyer, and, in general, all who occupy themselves with colors. Its great energy gives a passion for colors, but not necessarily a delicate taste in them. Taste depends upon a perfect, rather then a very powerful activity of the faculties.

24. *Locality.* The frontal sinus occurs occasionally, but not generally at the seat of locality, at the lower part of the forehead, over the inner end of the eyebrows. This faculty conduces to the desire for traveling, and constitutes a chief element in the talent for topography, geography, astronomy, and landscape painting. It gives what is called, *coup d' œil*, and judgment of the capabilities of ground. It is necessary to the military draughtsman; and is of great importance to a general in war. The lower order of animals possess the faculty and organ; and display great pow-

ers of retracing their way, when removed from their habitations. The instinctive tendency of several species of them to migrate at certain seasons, is inferred to be connected with the periodical excitement of this organ.

25. *Order.* Order supposes a plurality of objects; but one may have ideas about a number of things and other qualities, without considering them in any order whatever. There are individuals who are martyrs to the love of order, who are distressed beyond measure, by the sight of confusion, and highly satisfied when everything is well arranged. These persons have the organ in question large. The faculty of which we speak, gives method and order in arranging objects, as they are physically related; but philosophical or logical in ferences, the conception of systematizing or generalizing, and the idea of classifications, are formed by the reflecting faculties. Spurzheim relates, that the Sauvage de l'Aveyron at Paris, though an idiot in a very high degree, cannot bear to see a chair or any other object out of its place; and as soon as anything is deranged, he, without being excited to it, directly replaces it. He saw also in Edinburgh, a girl, who, in many respects was idiotic, but in whom the love of order was very active. She would avoid her brother's apartment, in consequence of the confusion which prevailed in it.

26. *Time.* The power of conceiving time, and of remembering circumstances connected by no link, but the relation in which they stand to each other in chronology, and also the power of observing time in performing music, is very different in different individuals. The special faculty seems to be the power of judging time, and of intervals in general. By giving the perception of measured cadence, it appears to be the chief source of pleasure in dancing. It is essential to music and versification.

27. *Number.* Some individuals, remarkable for their great talent of calculating, excited the attention of Dr. Gall. He found those, even in children, who excelled in this faculty. He mentions a boy of thirteen years old, who learned with facility a very long series of numbers, performed the most complicated arithmetical calculations from memory, and very soon found their true result. Similar talents were manifested in Zerah Colburn and several others, whom we might enumerate. In such individuals, the arch of the eyebrow is either much pressed downward, or there is an elevation at the external angle of the orbit. It is still doubted whether the lower animals possess this organ and faculty or not.

28. *Tune.* This organ bears the same relation to the ears, as the organ of color does to the eyes. The faculty gives the perception of melody; but this is only necessary in a genius for mu-

sic. Time is requisite to a just perception of intervals; ideality, to give elevation and refinement; secretiveness and imitation, to produce expression; and constructiveness, form, weight, and individuality are requisite besides, to supply the mechanical expertness, necessary to successful performance. Dr. Spurzheim observes, that the heads and skulls of birds which sing, and those which do not sing, and the heads of the different individuals of the same kind, that have a greater or less disposition to sing, present a conspicuous difference at the place of this organ. The heads of males, for instance, and those of females of the same kind of singing birds, are easily distinguished by their different developement.

29. *Language.* A large developement of this organ is indicated by the prominence and depression of the eyes; this appearance being produced by convolutions of the brain, situated in the posterior and transverse part of the upper orbitary plate, pressing the latter, and with it the eyes, more or less forward, downward, and outward, according to the size of the convolutions. The special faculty of this organ is, to enable us to acquire a knowledge of, and to give us the power of using artificial signs or words. Persons who have a great endowment of it abound in words. In ordinary conversation their language flows like a copious stream—in a speech, they pour out torrents. Individuality and comparison greatly assist this faculty, when applied to the acquisition of foreign languages and grammars.

Reflecting Faculties.

30. *Comparison.* This is an eminence of the form of a reversed pyramid, in the upper and middle portion of the frontal bone, and gives the power of perceiving resemblances, similitudes, and analogies. Tune may compare different notes; color contrast different shades; but comparison may compare a shade and a note, a form and a color, which the other faculties by themselves could not accomplish. In popular preachers, this organ is generally fully developed. It is more rarely deficient than any other intellectual organ; and the scripture is addressed to it in a remarkable degree, being full of analogies and comparisons. It tends to the invention and use of figurative language; and the speech of different nations is more or less characterized by this quality, according to the predominance of the organ.

31. *Causality.* This faculty is situated between comparison and wit, and furnishes the idea of *causation*, as implying something more than mere juxta-position or sequence,—and as forming an invisible bond of connexion between cause and effect. It impress-

es us with an irresistible conviction, that every phenomenon or change in nature is caused by something, and hence, by successive steps, leads us to the First Cause of all. It induces us on all occasions, to ask, *why*, and *wherefore*, is it so? It gives deep penetration, and the perception of logical consequences in argument. It is large in persons who possess a natural genius for metaphysics political economy, or similar sciences.

32. *Wit* is situated at the prominent and rounded anterior superior lateral parts of the forehead. When this developement is excessively large, it is attended with a disposition apparently irresistible, to view objects in a ludicrous light. When joined with combativeness and destructiveness large, it leads to satire; and even friends will then be sacrificed for the sake of a joke. It gives the talent also, for epigrams.

33. *Imitation*. This is situated at the superior-anterior part of the forehead. The faculty gives the power of imitation in general; and when joined with secretiveness, it gives expression in the fine arts. It is indispensable to portrait painters, sculptors, and engravers; and it gives the tendency, in speech and conversation, to fit the action to the words. It is generally active, and the organ large in children.

We refer those who wish to pursue the subject, to a popular treatise on Phrenology, by George Combe, and also the works of Gall and Spurzheim. There exists also in England, a phrenological society, who publish a phrenological journal.

CONCHOLOGY.

NO. VII.

Of the habitation of Testaceous Animals. To the detailed account which we have given of the natural history of testaceous animals, and particularly of the formation and growth of the shell, we have only to add a few observations concerning their habitation, the method of fishing, collecting and preserving them.

Testaceous animals are found in every part of the surface of the globe. Some are inhabitants of the land, while others only frequent rivers and lakes, and a third and numerous class live in the ocean. From this a classification of shells has been formed, and they have been divided into land, fresh water, and sea shells. But whatever difference might exist in the habits and

economy of testaceous animals which are produced in places so different, it affords few marks of discrimination for the purpose of classification.

Land shells are spread over the whole surface of the earth, and although more accessible, are perhaps less known than those which inhabit the ocean. From the small number of land shells which have been collected, it would appear, at first sight, that they are less numerous than marine shells. This, however, seems not to be the case, with regard to the number of species; and it is well known, that the number of individuals of land shells, in some instances, far exceeds that of sea shells. The sea shells of the Mediterranean have been observed by naturalists, to be nearly the same from the straits of Gibraltar to the island of Sicily; but the land shells of Languedoc are different from those of Provence, of Dauphiny, Peidmont, and different parts of Italy. Some are found in Spain, in Corsica, in Sardinia and Sicily, which are not to be met with in other places; and from the great variety and number of land shells, it seems probable that many of them are yet unknown. But let us now take a general view of those places of the world, where different testaceous animals are most frequently found.

It has been already observed, that light and heat have very considerable influence in adding to the splendor of the colors of shells. The most beautiful shells are found in countries between the tropics where they are more immediately subject to the direct rays of the sun, and a higher temperature. From these causes, the shells produced in these countries have a lustre and brilliancy, which those of colder climates never possess.

The shores of Asia furnish us with the pearl oysters and scallops in great perfection. About Amboyna, are found the most beautiful specimens of the cabbage shell, the *arrosoir*, the *ducal mantle*, and the coral or echinated oysters. Here also are found a great variety of extremely beautiful muscles, tellinæ, and volutæ; some fine buccinums, and the shell called the *Ethiopian crown* in its greatest perfection. The dolia, the murices, and the cassandræ, are also found on these coasts in great beauty. Many elegant snails and screw shells are also brought from thence; and finally the scorpion and spider shells. The Maldive and Philippine islands, Bengal, and the coast of Malabar, abound with the most elegant of all the species of snails, and furnish many other kinds of shells in great abundance and perfection. China abounds in the finest species of porcelain shells, and has also a great variety of beautiful snails. Japan furnishes us with all the thicker and larger bivalves; and the isle of Cyprus above all other parts of the

world, for the beauty and variety of the patella or limpet found there.

America affords very many elegant shells, but neither in so great abundance nor beauty as the shores of Asia. Panama is famous for the cylinders or rhombi, and we have besides, from the same place, some good porcelains, and very fine species of *dolium*, or *Concha globosa*, called from this place, the *Panama purple shell.* One of the most beautiful of the cylinders, is also known among naturalists, under the name of the *Panama shell.* About Brazil, and in the gulf of Mexico, there are found murices and dolia of extreme beauty; and also a great variety of porcelains, purpuræ, pectens, neritæ, bucardiæ, or heart shells, and elegant limpets. The island of Cayenna affords one of the most beautiful of the buccinum kind, and the Midas ear is found principally about this place. Jamaica and the island of Barbadoes have their shores covered with porcelain, chamæ, and buccina; and at St. Domingo, there are found almost all the same species of shells that we have from the East Indies; only they are less beautiful, and the colors more pale and dead. The pearl oyster is found also on this coast, but smaller than in the Persian Gulf. At Martinico there are found in general, the same shells as at St. Domingo, but yet less beautiful. About Canada are found the violet chamæ; and the lakes of that country abound with muscles of very elegant pale blue and pale red colors. Some species of these are remarkably light and thin; others are very thick and heavy. The Great Bank of Newfoundland is very barren in shells; the principal kind found there, are muscles of several species, some of which are of considerable beauty. About Carthagena there are many mother of pearl shells, but they are not of so brilliant colors as those of the Persian gulf. The island of Magellan, at the southern point of America, furnishes us with a very remarkable species of muscle called by its name; and several very elegant species of limpets found there, particularly the pyramidal.

In Africa, on the coast of Guinea, there is a prodigious quantity of that small species of porcelain which is used there as money; and there is another species of porcelain on the same coast which is all over white; the women make bracelets of the latter, and the people of the Levant adorn their hair with them. The coast of Zanguebar is very rich in shells; we find there a vast variety of the large porcelains, many of them of great beauty, and the *Nux maris*, or sea nut, is very frequent there. Beside these and many other shells, there are found on this coast all the species of nautili, many of which are very beautiful. The Canary Isles abound with a vast variety of the murices, and some other good shells; and we have

35

from Maderia great variety of the echine, or sea eggs, different from those of the European seas. Several species of muscle are also common there, and the sea ears are nowhere more abundant.

The Red Sea is beyond all other parts of the world abundant in shells; scarcely any kind is wanting there; but what we principally have from thence are the purpuræ, porcelains and the echine marini.

The Mediterranean and Northern Ocean contain a great variety of shells, and many of very remarkable elegance and beauty; they are upon the whole, however, greatly inferior to those of the East Indies. The Mediterranean abounds much more in shells than the Ocean. The gulf of Tarentum affords great variety of purpuræ, of porcelains, nautili, and elegant oysters; the coasts of Naples and Sardinia afford also the same, and with them a vast number of the solens of all the known species. The island of Sicily is famous for a very elegant kind of oyster which is entirely white; pinnæ marinæ and porcelains are also found in great plenty there, with tellinæ and chamæ of many species, and a great variety of other beautiful shells. Corsica is famous, beyond all other places, for the vast quantities of the pinnæ marinæ; and many other very beautiful shells, are found there. About Syracuse are found the gondola shell, alated murex, and a great variety of elegant snails, with some of the dolia and neritæ. The Adriatic Sea, or Gulf of Venice, is less furnished with shells than almost any of the seas thereabout. Muscles and oysters of several species are however found there, and some of the cordiform or heart shells; there are also some tellinæ. About Ancona there are vast numbers of the pholadas buried in stone, and the sea ears are particularly frequent about Pizzoli.

The ports of Marseilles, Toulon, and Antibes, are full of pinnæ marinæ, muscles, tellinæ and chamæ. The coasts of Bretagne afford great numbers of the conchæ anatiferæ and pousse peids; they are found on old rotten boards, on sea substances, and among clusters of sponges. The other ports of France, as Rochelle, Dunkirk, Brest, St. Maloes, and others, furnish oysters excellent for the table, but of the common kind and of no beauty in their shells; great numbers of muscles are also found there; and the common tellinæ, the onion peel oysters, the solens and the conchæ anatiferæ, are also found there. At Granville, in Lower Normandy, there are found very beautiful pectens, and some of the cordiform or heart shells.

The English coasts are not the least fruitful in shells, though they do not produce such elegantly painted ones as the Indies. About Plymouth are found oysters, muscles, and solens, in great abundance; and there, and on most of their shores, numbers of the aures marinæ and dentalia, with pectens, which are excellent food, and many

elegant species of the chamæ and tellinæ are fished up in the sea about Scarborough and other places. Ireland affords great numbers of muscles, and some very elegant scallop shells in great abundance and the pholades are frequent on most of their shores. They have also great variety of the buccina and cochleæ, and some volutæ ; and, on the Guernsey coast, a peculiarly beautiful snail, and called thence the Guernsey snail.

The coasts of Spain and Portugal afford much the same species of shells with the East Indies, but they are of much fainter colors and greatly inferior in beauty. There are, according to Tavernier and others, some rivers in Bavaria in which there are found pearls of a fine water. About Cadiz there are found very large pinnæ marinæ, and some fine buccina. The isles of Majorca and Minorca afford great variety of extremely elegant shells. The pinnae marinae are also very numerous there, and their silk is wrought into gloves, stockings, and other things. The Baltic affords a great many beautiful species, but particularly an orange-colored pecten or scallop shell, which is not found in any other part of the world.

The fresh water shells are found much more frequently, and in much greater plenty than the sea kinds ; there is scarce a pond, a ditch, or a river of fresh water in any part of the world, in which there are not found vast numbers of these shells with the fish living in them. Most these shells are small, and they are of very little beauty, being usually of a plain grayish or brownish color. The English ditches afford chamæ, buccina, neritæ, and some pattellæ ; but the Nile and some other rivers furnished the ancients with a species of tellina which was large and eatable, and so much superior to the common sea tellina in flavor, that it was commonly known by the name of *Tellina regia*, the 'Royal tellina.'

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. IX.

Attempts to produce silk from different animate creatures. 'The useful properties possessed by the produce of the silkworm, and the value which it has acquired among civilized communities, have, at various times, led ingenious men to seek among the works of nature for other substances, which, presenting appearances analogous to that beautiful filament, might be made equally conducive to human convenience and adornment.

'Some species of spiders are known to possess the power of not merely forming a web, but also of spinning, for the protection of their eggs, a bag somewhat similar in form and substance to the cocoon of the silkworm. At the commencement of the last century a method was discovered in France by Monsieur Bon, of procuring silk from these spiders' bags, and its use was attempted in the manufacture of several articles. The following particulars are gathered from a dissertation published at the time by M. Bon, and also from papers on the subject inserted in the volumes of the Royal Academy for the years 1710 and 1711.

'Spiders are usually classed according to their difference of color, whether black, brown, yellow, &c., or sometimes by the number and arrangement of their eyes: of these organs some possess no fewer than ten, others eight, and others again six. M. Bon has, however, noticed only two kinds of silk spiders, and these he has distinguished from each other as having either long or short legs, the last variety producing the finest quality of raw silk. According to this ingenious observer, the silk formed by these insects is equally beautiful, strong, and glossy with that formed by the bombyx. The spider spins minute fibres from fine papillæ, or small nipples, placed in the hinder part of its body. These papillæ serve the office of so many wire-drawing irons, to form and mould a viscous liquor, which after being drawn through them dries on exposure to the air, and forms the silk.

'The celebrated naturalist M. Reaumur, who likewise bestowed considerable attention on these insects, discovered that each of the papillæ consists of a number of smaller ones, so minute as not to be discernable, and only made evident by the effects produced. If the body of the spider be pressed between the fingers, the liquor from which the threads are formed flows into the papillæ, by applying the finger against which, distinct threads may then be drawn out through the several perforations of each papilla. These threads are too fine to be counted with any accuracy, but it is evident that very many are sent forth from each of the larger papillæ. This fact tends to explain the power possessed by the spider of producing threads having different degrees of tenuity. By applying more or fewer of these papillæ against the place whence it begins its web, the spider joins into one thread the almost imperceptible individual filaments which it draws from its body; the size of this thread being dependant on the number of nipples employed, and regulated by that instinct which teaches the creature to make choice of the degree of exility most appropriate to the work wherein it is about to engage. M. Bon was able to distinguish fifteen or twenty fibres in a single thread, while Reaumur relates that he has often counted as many as seventy or eighty fibres through a microscope, and perceived that there were

yet infinitely more than he could reckon; so that he believed himself to be far within the limit of truth in computing that the tip of each of the five papillæ furnished 1000 separate fibres: thus supposing that one slender filament of a spider's web is made up of 5000 fibres.

'The threads produced by spiders are of two kinds. The first, which serves only to form the web which the insect spreads to intrap its prey, is very fragile; while the second, which is used to inclose the eggs of the female, is much stronger, thus affording to them shelter from cold, and protection from other insects which might otherwise destroy them. The threads are, in this operation, wound very loosely round the eggs, in a shape resembling that of the cocoon of the silkworm, after it has been prepared and loosened for the distaff.

'When first formed, the color of these spiders' bags is gray, but, by exposure to the air, they soon acquire a blackish hue. Other spider bags might probably be found of other colors, and affording silk of better quality, but their scarcity would render any experiment with them difficult of accomplishment; for which reason M. Bon confined his attention to the bags of the common sort of the short-legged kind.

'These always form their bags in some place sheltered from the wind and rain, such as the hollow trunks of trees, the corners of windows or vaults, or under the eaves of houses. A quantity of these bags was collected by M. Bon, from which a new kind of silk was made, said to be in no respect inferior to the silk of the bombyx. It took readily all kinds of dyes, and might have been wrought into any description of silken fabric. M. Bon had stockings and gloves made from it, some of which he presented to the Royal Academy of Paris, and others he transmitted to the Royal Society of London.

'This silk was prepared in the following manner:—Twelve or thirteen ounces of the bags were beaten with the hand, or by a stick, until they were entirely freed from dust. They were next washed in warm water, which was continually changed, until it no longer became clouded or discolored by the bags under process. After this they were steeped in a large quantity of water wherein soap, saltpetre, and gum arabic had been dissolved. The whole was then set to boil over a gentle fire during three hours, after which the bags were rinsed in clear warm water to discharge the soap. They were finally set out to dry, during some days previous to the operation of carding, which was then performed with cards differing from those usually employed with silk in being much finer. By these means silk of a peculiar ash color was obtained, which was spun without difficulty. M. Bon affirmed that the thread was both stronger and finer than common silk, and that therefore fabrics similar to those made with the latter material might be manufactured from this, there being

no reason for doubting that it would stand any trials of the loom, after having undergone those of the stocking frame.

' The only obstacle, therefore, which appeared to prevent the establishing of any considerable manufacture from these spider bags was the difficulty of obtaining them in sufficient abundance. M. Bon fancied that this objection could soon be overcome, and that the art of domesticating and rearing spiders, as practised with silkworms, was to be attained. Carried away by the enthusiasm of one, who, having made a discovery, pursues it with ardor undismayed by difficulties, he met every objection by comparisons, which perhaps were not wholly and strictly founded on fact. Contrasted with the spider, and to favor his arguments, the silkworm in his hands made a very despicable figure. He affirmed that the female spider produces 600 or 700 eggs; while of the 100, to which number he limited the silkworm, not more than one half were reared to produce balls. That the spiders hatched spontaneously, without any care, in the months of August and September; that the old spiders dying soon after they have laid their eggs, the young ones live for ten or twelve months without food and continue in their bags without growing, until the hot weather, by putting their viscid juices in motion, induces them to come forth, spin, and run about in search of food.

' Mons. Bon flattered himself by this partial comparison, that if a method could be found of breeding young spiders in apartments, they would furnish a much greater quantity of bags than silkworms. Of about 700 or 800 young spiders which he kept, hardly one died in a year; whereas, according to this gentleman's estimate, of 100 silkworms not forty lived to form their cocoons. His spider establishment was managed in the following manner :—Having ordered all the short-legged spiders which could be collected by persons employed for the purpose, to be brought to him, he inclosed them in paper coffins and pots; these were covered with papers, which, as well as the coffins, were pricked over their surface with pin holes to admit air to the prisoners. The insects were duly fed with flies, and after some time it was found on inspection that the greater part of them had formed their bags. This advocate for the rearing of spiders contended that spiders' bags afforded much more silk in proportion to their weight than those of the silkworm; in proof of which he observed, that thirteen ounces yield nearly four ounces of pure silk, two ounces of which were sufficient to make a pair of stockings; whereas stockings made of common silk were said by him to weigh seven or eight ounces.

' Some persons had imagined that the spider was venomous, and

that this evil quality extended to the silk which it produced. Mons. Bon combated this prejudice by the assertion, that he had several times been bitten by spiders, when no injury had ensued; and that the silk, so far from being pernicious, had been found efficacious in stanching and healing wounds, its natural gluten acting as a kind of balsam. Determined upon extracting every possible good from this his favorite pursuit, he subjected the spider silk to chemical analysis, and obtained from it a volatile salt, preparing which in the same manner used for the *guttæ Anglicanæ* once so famous all over Europe, he produced drops which, as he believed, possessed greater efficacy than even these: he called this preparation Montpelier drops, and recommended its application in all lethargic diseases.

'The Royal Academy of Paris having considered the subject deserving of investigation, appointed M. Reaumur to inquire into the merits of this new silken material. In the course of his examination this naturalist discovered many serious objections, the narration of which will show the inexpediency of M. Bon's projected establishments. Mons. Reaumur urged that the natural fierceness of spiders rendered them wholly unfit to be bred and reared together. On distributing 4000 or 5000 into cells, in companies of from 50 to 100 or 200, it was found that the larger spiders quickly killed and ate the smaller, so that in a short time the cells were depopulated, scarcely more than one or two being found in each cell. To this propensity for mutual destruction, M. Reaumur ascribes the scarcity of spiders in comparison with the vast number of eggs which they produce. But if even it were possible to change their warlike nature and bring these insects together in peaceful community, there are other objections to deter from the attempt.

'M. Reaumur affirmed, that the silk of the spider is inferior to that of the silkworm, both in lustre and strength, and that it produced proportionally less material available to purposes of manufacture. All this was satisfactorily proved; although in his reasoning some little exaggeration was likewise employed in opposition to the coloring of M. Bon. The thread of the spider's web was found capable of sustaining a weight of only two grains without breaking; and the filament of the bag, although much stronger than this, could only sustain thirty-six grains, while that of the silkworm will support a weight of two drachms and a half. "Thus five" (four ?) "threads of the spider," said M. Reaumur, "must be brought together to equal one thread of the silkworm." Now it is impossible that these should be applied so justly over one another as not to leave little vacant spaces between them, whence

the light will not be reflected; and, consequently, a thread thus compounded cannot equal in lustre a solid thread. It is another great disadvantage of the spider's silk, that it cannot be wound off the ball like that of the silkworm, but must necessarily be carded; and therefore its evenness, which contributes so materially to its lustre, is destroyed. That this effect was in reality produced, is further confirmed by the testimony of M. le Hire, who, when the stockings of M. Bon were presented to the Royal Academy, immediately noticed their want of lustre.

'Another objection urged by M. Reaumur against the rearing of spiders was the small quantity as well as deficient quality of the silk they produce. In making a comparison in this respect between them and the silkworm, extreme cases were taken, that the conclusion might be rendered more striking. "The largest cocoons," said this naturalist, "weigh four and the smaller three grains each; spiders' bags do not weigh above one grain each, and, after being cleared of their dust, have lost two thirds of this weight." He calculated, therefore, that the work of twelve spiders only equals that of one silkworm; and that a pound of silk would require for its production 27,648 insects. But as the bags are wholly the work of the females, who spin them as a deposit for their eggs, it follows that 55,296 spiders must be reared to yield one pound of silk: yet even this will be obtained from only the best spiders, those large ones ordinarily seen in gardens, *&c.*, yielding not more than a twelfth part the silk of the others. The work of 280 of these would, therefore, not yield more silk than the produce of one industrious silkworm, and 663,552 of them would furnish only one pound of silk! This latter calculation is however decidedly erroneous in its several steps, and appears rather to be a flight of the imagination than the result of sober induction. The advantages of the culture of silk from the silkworm, when compared with its production from spiders, are so prodigious, and at the same time so evident, that to prove the futility of M. Bon's scheme needed not the aid of exaggeration.

'Human ingenuity has been somewhat more successfully exercised in seeking, many feet below the surface of the ocean, for slender filaments, the produce of an animal in almost a vegetative state of existence.

'The *pinna* belongs, like the common edible muscle, to the order of the *Vermes testacea.* The animal is a limax, its shell is bivalve, fragile, and furnished with a beard; the valves hinge without a tooth. The pinna does not fasten itself to rocks in the same situation as the muscle, but sticks its sharp end into the mud or sand, while the rest of the shell remains at liberty to open in the

water. In common with the muscle, it has the power of spinning a viscid matter from its body, in the manner of the spider and caterpillar. Although the pinna is vastly larger than the muscle, its shell being often found two feet long, the threads which it produces are much more delicate and slender than those of the muscle, and scarcely inferior in fineness and beauty to the single filament of the comparatively minute silkworm. Threads so delicately thin, as may readily be imagined, do not singly possess much strength ; but the little power of each is made up by the aggregate of the almost infinite number which each fish puts forth to secure itself in a fixed situation, and to preserve it against the rolling of the waves. The threads are, however, similar in their nature to those of the muscle, differing only in their superior fineness and greater length. These fish have, therefore, been distinguished by some naturalists, the one as the silkworm, the other as the caterpillar of the sea.

'It was always well known that muscles have the power of affixing themselves either to rocks or to the shells of one another, in a very firm manner ; yet their method of effecting this was not understood until explained through the accurate observations of M. Reaumur. He was the first naturalist who ascertained that if, by any accident, the animals were torn from their hold, they possessed the power of substituting other threads for those which had been broken or injured. He found that if muscles, detached from each other, were placed in any kind of vessel and then plunged into the sea, they contrived in a very short time to fasten themselves both to the sides of the vessel and to one another's shells : in this process, the extremity of each thread seemed to perform the office of a hand in seizing upon the body to which it would attach itself.

'The threads issue from the shell at that part where it naturally opens, and, in affixing themselves to any substance, form numerous minute cables, by aid of which the fish steadies itself in the water. Each animal is furnished with an organ, which it is difficult to designate by any name, since it performs the office of so many members, and is the only indicator of the existence of vital powers in the creature. It is by turns a tongue, an arm, and sometimes a leg. Its shape resembles that of a tongue, and it is, therefore, most frequently called by that name. Whenever the fish requires to change its place, this member serves to drag its body forward, together with its cumbrous habitation : in performing its journey the extremity of this organ, which may then be called a leg, is fixed to some solid body, and being then contracted in its length, the whole fish is necessarily drawn towards the spot where it has fixed itself ; and by a repetition of these movements,

the animal arrives at his destination. It is not often that the organ is put to this use, as the pinna is but little addicted to locomotion : some naturalists indeed affirm that it is always stationary. The use to which the tongue is most frequently applied is that of spinning the threads. Although this body is flat, and similar in form to a tongue through the greater part of its length, it becomes cylindrical about the base or root, where it is much smaller than in any other part : at this lower end are several ligatures of a muscular nature, which hold the tongue firmly fixed against the middle of the shell ; four of these cords are very apparent, and serve to move the tongue in any direction according to the wants of the fish. Through the entire length of this member there runs a slit, which pierces very deeply into its substance, so as almost to divide it into two longitudinal sections ; this slit performs the office of a canal for the liquor of which the threads are formed, and serves to mould them into their proper form : this canal appears externally like a small crack, being almost covered by the flesh from either side, but internally it is much wider, and is surrounded by circular fibres. The channel thus formed extends regularly from the tip to the base of the tongue, where it partakes of the form of the member and becomes cylindric, forming there a close tube or pipe in which the canal terminates. The viscid substance is moulded in this tube into the form of a cord, similar to the threads produced from it, but much thicker, and from this cord all the minute fibres issue and disperse. The internal surface of the tube in which the large cord is formed is furnished with glands for the secretion of the peculiar liquor employed in its production, and which liquor is always in great abundance in this animal as well as in muscles.

'Reaumur observed, that although the workmanship, when completed, of the land and sea animals, is the same, the manner of its production is very different. Spiders, caterpillars, and the like, form threads of any required length, by making the viscous liquor of which the filament is formed pass through fine perforations in the organ appointed for this spinning. But the way in which muscles form their thread is very different ; as the former resembles the work of the wire-drawer, so does the latter that of the founder who casts metals in a mould. The canal of the organ destined for the muscle's spinning is the mould in which its thread is cast, and gives to it its determinate length.

'Reaumur learned the manner of the muscle performing the operation of spinning by actually placing some of these fish under his constant inspection. He kept them in his apartment in a vessel filled with sea water, and distinctly saw them open their shells

and put forth the tongue. They extended and contracted this organ several times, obtruding it in every direction, as if seeking the fittest place whereon to fix their threads. After these trials had been often repeated, the tongue of one was observed to remain for some time on the spot chosen, and being then drawn back with great quickness, a thread was very easily discerned, fastened to the place: this operation was repeated, until all the threads were in sufficient number, one fibre being produced at each movement of the tongue.

'The old threads were found to differ materially from those newly spun, the latter being whiter, more glossy, and more transparent than the former, and it was thence discovered that it was not the office of the tongue to transfer the old threads one by one to the new spots where they were fixed, which course M. Reaumur had thought was pursued. The old threads once severed from the spot to which they had been originally fixed were seen to be useless, and that every fibre employed by the fish to secure itself in a new position was produced at the time it was required; and, in short, that nature had endowed some fish, as well as many land insects, with the power of spinning threads, as their natural wants and instincts demanded. This fact was established incontrovertibly by cutting away, as close to the body as they could be safely separated, the old threads, which were always replaced by others in as short a space of time as was employed by other muscles not so deprived in fixing themselves.

'"The pinna and its cancer friend" have on more than one occasion been made subjects for poetry. There is doubtless some foundation for the fact of the mutual alliance between these aquatic friends which has been thus celebrated; yet some slight coloring may have been borrowed from the regions of fancy to adorn the verse, and even the prose history of their attachment may be exposed to the same objection.

'These fish are found on the coasts of Provence and Italy, and in the Indian ocean. The largest and most remarkable species inhabits the Mediterranean Sea.

'The scuttle fish *, a native of the same seas as the pinna, is its deadly foe, and would quickly destroy it, if it were not for its faithful ally. In common with all the same species, the pinna is without the organs of sight, and could not, therefore, unassisted, be aware of the vicinity of its dangerous enemy. A small animal of the crab kind, itself destitute of a covering, but extremely quick-sighted, takes refuge in the shell of the pinna, whose strong call

* This species is the Octopodia, with eight arms connected at theirb ottoms by a membrane: it is the Polypus of Pliny.

careous valves afford a shelter to her guest, while he makes a return for this protection by going forth in search of prey. At these times the pinna opens her valves to afford him egress and ingress: if the watchful scuttle fish now approach, the crab returns immediately with notice of the danger to her hostess, who, timely warned, shuts her door and keeps out the enemy. When the crab has, unmolested, succeeded in loading itself with provisions, it gives notice by a gentle noise at the opening of the shell, and when admitted, the two friends feast together on the fruit of its industry. It would appear an arduous, nay, almost an impossible task, for the defenceless and diminutive crab, not merely to elude its enemies and return home, but likewise to obtain a supply of provender sufficient to satisfy the wants of its larger companion. The following different account of the nature of this alliance is much more in agreement with probability :—

'Whenever the pinna ventures to open its shell, it is immediately exposed to the attacks of various of the smaller kinds of fish, which, finding no resistance to their first assaults, acquire boldness and venture in. The vigilant guard, by a gentle bite, gives notice of this to his companion, who, upon this hint, closes her shell, and having thus shut them in makes a prey of those who had come to prey upon her: when thus supplied with food she never fails to share her booty with so useful an ally.

'We are told that the sagacious observer, Dr. Hasselquist, in his voyage about the middle of the last century to Palestine, which he undertook for objects connected with the study of natural history, beheld this curious phenomenon, which, though well known to the ancients, had escaped the attention of the moderns.

'It is related by Aristotle that the pinna keeps a guard to watch for her, which grows to her mouth, and serves as her caterer: this he calls pinnophylax, and describes as a little fish with claws like a crab. Pliny observes, that the smallest species of crab is called the pinnotores, and being from its diminutive size liable to injury, has the prudence to conceal itself in the shells of oysters. In another place he describes the pinna as of the genus of shell-fish, with the further particulars that it is found in muddy waters, always erect, and never without a companion, called by some pinnotores, by others pinnophylax; this being sometimes a small squill, sometimes a crab, which remains with the pinna for the sake of food.

'The description of the pinna by the Greek poet Oppianus, who flourished in the second century, has been thus given in English verse :—

"The pinna and the crab together dwell,
For mutual succour in one common shell;
They both to gain a livelihood combine,
That takes the prey, when this has given the sign;
From hence this crab, above his fellows famed,
By ancient Greeks was Pinnotores named."

'It is said that the pinna fastens itself so strongly to the rocks, that the men who are employed in fishing it are obliged to use considerable force to break the tuft of threads by which it is secured fifteen, twenty, and sometimes thirty feet below the surface of the sea.

'The fishermen at Toulon use an instrument called a cramp for this curious pursuit. This is a kind of iron fork, whose prongs are each about eight feet in length and six inches apart, and placed at right angles to the handle, the length of which is regulated by the depth of water. The pinnæ are seized, separated from the rock, and raised to the surface by means of this instrument.

'The threads of the pinna have from very ancient time been employed in the manufacture of certain fabrics. This material was well known to the ancients, as some suppose, under the name of byssus, and was wrought in very early times into gloves and other articles of dress and ornament. It appears that robes were sometimes made of this produce, since we learn from Procopius that a robe composed of byssus of the pinna was presented to the satraps of Armenia by the Roman emperor.

'A writer of the year 1782 evidently refers to the pinnæ marinæ, when he says, "The ancients had a manufacture of silk, and which, about forty years ago, was revived at Tarento and Regio in the kingdom of Naples. It consists of a strong brown silk, belonging to some sort of shell, of which they make caps, gloves, stockings, waistcoats, &c., warmer than the woollen stuffs, and brighter than common silk. I have seen such kind of silk in shells myself; I think it was of the pecten kind, but cannot be sure."

'Several beautiful manufactures are wrought with these threads at Palermo. They are in many places the chief objects of the fishery, and the silk is found to be excellent. The produce of a considerable number of pinnæ is required to make only one pair of stockings. The delicacy of this singular thread is such that a pair of stockings made of it can be easily contained in a snuff box of ordinary size. Some stockings of this material were presented, in the year 1754, to pope Benedict XIV.; and, notwithstanding their extreme fineness, were found to protect the legs alike from cold and heat. Stockings and gloves of this production, however thin, are too warm for common wear, but are esteemed

useful in gouty and rheumatic cases. This great warmth of the byssus, like the similar quality in silk, results probably from both being imperfect conductors of heat as well as of electricity.

'' It is not probable that this material will ever be obtained in much abundance, or that it will cease to be a rarity, except in the places of its production. It is never seen in England save in the cabinets of the curious.

' The appearance and general characteristics of the produce of the pinna, the spider, and the silkworm, are so similar, as to have acquired for them one generic name. If all their constituent parts be alike, it forms another among the numerous subjects for surprise and admiration, excited by contemplating the wonderful works of nature, that the same silky principle can be alike elaborated from the fish, the fly, and the mulberry leaf.'

THE MICROSCOPE.

NO. III.

ACTIVE MOLECULES, CONTINUED.

Butterflies and Moths. We cannot enumerate all the different sorts of these beautiful insects, and it is impossible to describe the variety and splendor of their plumages, surpassing all the magnificence of the richest and most costly dress. All the butterfly and moth tribes are bred from caterpillars. The number of these insects is very great; Linnæus reckoned eight or nine hundred different kinds, some of which are extremely rare, and only found in particular places. The legs, antennæ, the eyes, in fact every part, when examined, afford the highest entertainment.

Dust of the Feathers of a Butterfly's Wing. The wings in themselves are, like the common fly's, transparent, but owe their opacity to the beautiful minute feathers which cover them; and, examined by the microscope, nothing can exceed the beautiful and regular arrangement of these little substances, which, by their different colors, serve to paint the wing, and by their regular layers, resembles the tiles of a house-top. Carefully brush some of the dust off on your slide, between two pieces of talc, place it under the microscope, and you will be richly rewarded for the trouble taken. With a high power and strong light, beautiful prismatic colors and lines may be discovered.

The Hair-like Animalcule. This wonderful little insect, from its resemblance to a fine hair, is called the hair-like insect. All its motions are extremely slow, and require much patience and attention in the observer: it has neither feet nor fins, but appears perfectly smooth and transparent. These creatures are so small that millions might be contained in a square inch; they are found in the sediment or mud in ditches, and sometimes in vegetable infusions; a quantity of this should be procured, and put into a glass vessel; myriads may be seen to crawl up the sides of the glass.

The Cat Animal. In the same water or sediment may be found the oat animalcule, so called from its resemblance to a grain of oats; it is inclosed in a shell, which it opens and shuts, but can change its place only by sudden jerks or leaps. This little creature is so extremely small, that it requires the greatest magnifier to examine it.

Cheese Mites. Mites are those minute creatures found in cheese. To the eye they appear like moving particles of dust, but the microscope discovers them to be animals, perfect in all their parts, having as regular a figure, and performing all the functions of life as well as those animals which are many millions times their size. The head is formed like a pig's, they have two small eyes, and are extremely quick-sighted. Each leg has six joints, with claws. The body is covered with long hair. These creatures, male and female, are produced from the eggs, and come forth perfect insects; though extremely minute, you may sometimes see them break the shell and force their way out. The egg itself is a curious object for the microscope. The mites may be kept alive for months, between two glasses, or in the object box. The best method of preserving them for the microscope is to put some bits of old cheese into a small phial and pierce some holes in the cork for air: by gently heating the bottle, they will crawl up the sides, and through the holes of the cork, and can be brushed off with a camel-hair brush, free from dirt, on the glass. Mites may also be found in stale flour, or in the dust of the dried fig. Mr. T. Carpenter, among many other curious anatomical dissections, has succeeded in dissecting the jaws of one of these insects, and has displayed them most beautifully between two pieces of glass: they are, as may be supposed, extremely delicate, but can be seen very distinctly.

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[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.	
Day.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Inches.	
1	64	87	78	30.11	30.08	30.07	Fair	Fair	Fair	S. W.	S. W.	S. W.		
2	73	91	76	30.04	30.01	30.00	Fair	Fair	Fair	S. W.	S. W.	S. W.		
3	72	88	76	29.98	29.90	29.89	Fair	Fair	Fair	S. W.	S. W.	S. W		
4	67	78	68	29.98	30.02	30.02	Fair	Fair	Fair	N. E.	E.	S. W.		
5	62	81	68	30.12	30.12	30.10	Fair	Fair	Fair	S. W.	S. W.	S. W.		
6	63	86	72	30.08	30.04	30.01	Fair	Fair	Fair	S. W.	S. W.	S. W.		
7	67	71	55	29.95	29.96	30.02	Fair	Fair	Cloudy	S. W.	N. E.	N. E.		
8	55	60	56	30.00	30.00	29.97	Cloudy	Cloudy	Cloudy	N. E.	N. E.	N. E.		
9	56	57	52	29.91	29.90	29.88	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.		
10	53	60	54	29.81	29.87	29.92	Cloudy	Cloudy	Cloudy	N. E.	N. E.	N. E.	0.33	
11	51	51	50	29.89	29.88	29.80	Cloudy	Rain	Cloudy	N. E.	N. E.	N. E.	0.21	
12	52	62	59	29.72	29.72	29.75	Fair	Show's	Fair	N. W.	S. W.	N. W.	0.06	
13	56	68	60	29.71	29.70	29.78	Fair	Fair	Fair	S. W.	N. W.	N. W.		
14	54	63	60	29.82	29.85	29.95	Fair	Fair	Fair	N. W.	E.	S. W.	0.02	
15	55	68	62	30.01	30.05	30.11	Fair	Fair	Fair	N. W.	E.	S. W.		
16	54	70	65	30.10	30.10	30.10	Fair	Fair	Fair	N. W.	E.	S. W.	0.01	Show's
17	64	68	67	30.11	30.12	30.15	Cloudy	Fair	Fair	S. W.	E.	S. W.		
18	62	82	70	30.15	30.15	30.05	Fair	Fair	Fair	S. W.	S. W.	S. W.		
19	68	86	70	29.98	29.95	29.75	Fair	Fair	Fair	S. W.	S. W.	S. W.	0.21	Show's
20	68	80	73	29.72	29.71	29.74	Fair	Fair	Cloudy	N. W.	N. W.	N. W.		
21	66	68	60	29.70	29.65	29.78	Rain	Cloudy	Fair	S. W.	N. E.	N. W.	0.09	
22	58	68	64	29.88	29.95	30.02	Fair	Fair	Fair	N. W.	E.	S. W.		
23	58	70	61	30.12	30.15	30.18	Fair	Fair	Fair	N. W.	E.	S. W.		
24	58	74	68	30.15	30.10	30.03	Fair	Fair	Cloudy	S. W.	S. W.	S. W.		
25	64	74	64	29.90	29.90	29.82	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	0.73	Show's
26	58	68	62	29.79	29.80	29.90	Cloudy	Fair	Fair	N. W.	E.	S. W.	0.13	Show's
27	58	76	65	29.96	30.02	30.11	Fair	Fair	Fair	N. W.	N. W.	S. W.		
28	60	81	67	30.12	30.12	30.12	Fair	Fair	Fair	S. W	S. W.	S. W.		
29	65	81	69	30.10	30.09	30.05	Fair	Fair	Fair	S. W.	S. W.	S. W.		
30	63	81	74	30.00	30.01	30.03	Cloudy	Fair	Fair	S. W.	S. W.	S. W.		Rain &
31	70	76	68	30.06	30.10	30.12	Cloudy	Fair	Cloudy	S. W.	E.	S. W.	1.12	Show's

Depth of rain fallen 2.91 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

Pl. X.

Mode of inflating the Balloon with Hydrogen Gas.

Pl. X.

Pendleton's Lithog.' Bos.

Mode of inflating the Balloon with Hydrogen Gas.

THE NATURALIST.

OCTOBER, 1832.

AEROSTATION.

Aerostation, in the modern application of the term, signifies the art of navigating through the air, both in its principles and practice. Hence also the machines which are employed for this purpose, are called aerostats, or aerostatic machines ; and, on account of their round figure, air balloons. In 1729, Bartholomew Gusman, a Jesuit, of Lisbon, caused an aerostatic machine, in the form of a bird, to be constructed ; and made it to ascend, by means of a fire kindled under it, in the presence of the king, queen, and a great concourse of spectators. Unfortunately, in rising, it struck against a cornice, was torn, and fell to the ground. The inventor proposed renewing his experiment ; but the people had denounced him to the inquisition as a sorcerer, and he withdrew into Spain, where he died in an hospital. In 1766, the Honorable Henry Cavendish discovered that inflammable air (*hydrogen gas*) was at least seven times as light as the common air. It soon afterwards occurred to the celebrated Dr. Black, that if a thin bag were filled with this gaseous substance, it would, according to the established laws of specific gravity, rise in the common atmosphere ; but he did not pursue the inquiry. The same idea was next conceived by Mr. Cavallo, to whom is generally ascribed the honor of commencing the experiments on this subject. He had made but little progress, however, in these experiments, when the discovery of Stephen and John Montgolfier, paper manufacturers of France, was announced in 1782, and engaged the attention of the philosophical world. Observing the natural ascent of

smoke and clouds in the atmosphere, those artists were led to suppose that heated air, if inclosed in a suitable covering, would also prove buoyant. Accordingly, after several smaller experiments, by which this idea was fully confirmed, they inflated a large balloon with rarefied air, on the fifth of June, 1783, which immediately and rapidly rose to the height of six thousand feet, and answered their most sanguine expectations.

It was soon found that machines of this kind might be so contrived as to convey small animals and even human beings, through the air with ease. The first human adventurer in this aerial navigation was M. Pilatre de Rozier, a daring Frenchman, who rose in a large balloon, from a garden in the city of Paris, on the 15th of October, 1783, and remained a considerable time suspended in the air. He made several aerial voyages of greater extent afterwards, and in two of them was attended by other persons. In a short time, however, the use of rarefied air in aerostation was, for the most part, laid aside, as inconvenient and unsafe. On recurring once more to the discovery of Mr. Cavendish, the philosophers of Paris concluded that a balloon inflated with inflammable air would answer all the purposes of that contrived by the Montgolfiers, and would also possess several additional advantages. They made their first experiment on the 23d of August, 1783, which was attended with complete success. The first human beings who ventured to ascend in a balloon raised upon this plan were Messrs. Charles and Roberts, who rose from Paris, on the 1st day of December in the same year. The inflammable air balloons have been generally used since that time.

The first aerial voyage in England was performed in London, on the 15th of September, 1784, by Vincent Lunardi, a native of Italy. His balloon was made of oiled silk, painted in alternate stripes of blue and red. Its diameter was thirty-three feet. From a net which went over two-thirds of the balloon, descended forty-five cords to a hoop hanging below the balloon, and to which the gallery was attached. The balloon had no valve; and its neck which terminated in the form of a pear, was the aperture through which the inflammable air was introduced, and through which it might be let out. The air for filling the balloon was produced from zinc by means of vitriolic acid. M. Lunardi departed from the artillery ground at two o'clock; and with him were a dog, a cat, and a pigeon. After throwing out some sand, to clear the houses, he ascended to a great height. The direction of his motion was at first north west by west; but as the balloon rose higher, it fell into another current of air, which carried it nearly north. About half after three he descended very near the ground, and

landed the cat, which was almost dead with cold ; then rising, he prosecuted his voyage. He ascribes his descent to the action of an oar ; but as he was under the necessity of throwing out ballast in order to reascend, his descent was more probably occasioned by the loss of inflammable air. At ten minutes past four he descended on a meadow, near Ware, in Hertfordshire. The only philosophical instrument which he carried with him was a thermometer, which in the course of his voyage stood as low as 29°, and he observed that the drops of water which collected round the balloon were frozen.

The largest and the most interesting voyage, which was performed about this time, was that of Messrs. Roberts and Mr. Collin. Hullin, at Paris, on the 19th of September, 1784. Their aerostat was filled with inflammable air. Its diameter was twenty-seven feet and three-quarters, and its length was forty-six feet and three-quarters, and it was made to float with its longest part parallel to the horizon, with a boat nearly seventeen feet long attached to a net that went over it as far as its middle. To the boat were annexed wings, or oars, in the form of an umbrella. At twelve o'clock they ascended, with four hundred and fifty pounds of ballast, and after various manœuvres descended at forty minutes past six o'clock near Arras, in Artois, having still two hundred pounds of their ballast remaining in the boat. Having risen about one thousand four hundred feet, they perceived stormy clouds, which they endeavored to avoid, but the current of air was uniform from the height of six hundred to four thousand two hundred feet. The barometer on the coast of the sea was 29·61 inches, and sunk to 23·94 inches. They found that by working with their oars they accelerated their course. In the prosecution of their voyage, which was one hundred and fifty miles, they heard two claps of thunder ; and the cold occasioned by the approach of stormy clouds made the thermometer fall from seventy-seven degrees to fifty-nine degrees, and condensed the inflammable air in the balloon, so as to make it descend very low. From some experiments, they concluded that they were able by the use of two oars to deviate from the direction of the wind about twenty-two degrees. But this experiment requires repetition, in order to ascertain with accuracy the effect here ascribed to oars.

The second aerial voyage in England was performed by Mr. Blanchard and Mr. Shelton, professor of anatomy to the Royal Academy, the first Englishmen who ascended with an aerostatic machine. This experiment was performed at Chelsea on the 16th of October, 1784. The wings used on this occasion seemed to have produced no deviation in the machine's track from the di-

rection of the wind. Mr. Blanchard, having landed his friend about the distance of fourteen miles from Chelsea, proceeded along with different currents, and ascended so high as to experience great difficulty of breathing. A pigeon also, which flew away from the boat, labored for some time with its wings, in order to sustain itself in the rarefied air, and after wandering for a considerable time, returned and rested on one side of the boat. Mr. Blanchard perceiving the sea before him, descended near Rumsey, about seventy-five miles from London, having travelled at the rate of nearly twenty miles an hour. The fate of M. P. de Rozier, the first aerial navigator, and of his companion M. Romain, has been much lamented. They ascended at Bologne, on July 15, 1785, with an intention of crossing the channel to England. Their machine consisted of a spherical balloon, thirty-seven feet in diameter, filled with inflammable air, and under this balloon was suspended a small montgolfier, or fire balloon, ten feet in diameter. This montgolfier was designed for rarefying the atmospheric air, and thus diminishing the specific gravity of the whole apparatus. For the first twenty minutes they seemed to pursue the proper course; but the balloon appeared to be much inflated, and the aeronauts appeared anxious to descend. Soon, however, when they were at the height of about three-quarters of a mile, the whole apparatus was in flames, and the unfortunate adventurers fell to the ground, and were killed on the spot.

On the 19th of July, 1785, Mr. Crosbie ascended at Dublin, with a view of crossing the channel to England. To a wicker basket of a circular form, which he had substituted for the boat, he had affixed a number of bladders, for the purpose of rendering his gallery buoyant, in case of a disaster at sea. The height to which he ascended at one time was such, that by the intense cold, his ink was frozen, and the mercury sunk into the ball of the thermometer. He himself was sick, and he felt a strong impression on the tympanum of his ears. At his utmost elevation he thought himself stationary; but on discharging some gas he descended to a very rough current of air blowing to the north. He then entered a dense cloud, and experienced strong blasts of wind, with thunder and lightning, which brought him with rapidity towards the surface of the water. The water soon entered his car; the force of the wind plunged him into the ocean, and it was with difficulty that he put on his cork jacket. The bladders which he had prepared were now found of great use. The water, added to his own weight, served as ballast; and the balloon maintaining its poise, answered the purpose of a sail, by means of which, and a snatch block to his car, he moved before the wind as regularly

as a sailing boat. He was at length overtaken by some vessels who were crowding sail after him, and conveyed to Dunleary with the balloon. On the 22d of July, Major Money, who ascended at Norwich, was driven out to sea, and after having been blown about for nearly two hours, he dropped into the water. After much exertion for preserving his life, and when he was almost despairing of relief, he was taken up by a revenue cutter in a state of extreme weakness ; having been struggling to keep himself above water for about seven hours.

The longest voyage that had been hitherto made was performed by Mr. Blanchard, towards the end of August, 1785. He ascended at Lisle, accompanied by the Chevalier de l'Epinard, and traversed a distance of three hundred miles before they descended. On this, as well as on other occasions, Mr. Blanchard made trial of a parachute, in the form of a large umbrella, which he contrived for breaking his fall in case of any accident. With this machine he let down a dog, which came to the ground gently and unhurt. On the 8th of September, Mr. Baldwin ascended from the city of Chester, and performed an aerial voyage of twenty-five miles in two hours and a quarter. His greatest elevation was about a mile and a half, and he supposed that the velocity of his motion was sometimes at the rate of twenty miles an hour. He has published a circumstantial account of his voyage ; described the appearances of the clouds as he passed through them ; and annexed a variety of observations relating to aerostation. The science of aerostation is much indebted to the skill and intrepidity of this celebrated aeronaut.

The singular experiment of ascending into the atmosphere with a balloon, and of descending with a machine called a parachute, was performed by Mr. Garnerin, on the 21st of September, 1802. He ascended from St. George's parade, North Audley Street, and descended safe into a field near the small pox hospital, at Pancras. The balloon began to be filled about two o'clock. At six, the balloon being quite full of gas, and the parachute, &c. being attached to it, Mr. Garnerin placed himself in the basket, and ascended majestically amidst the acclamations of innumerable spectators. The weather was the clearest and pleasantest imaginable ; the wind was gentle, and about west by south ; in consequence of which Mr. Garnerin went into the direction of nearly east by north. In about eight minutes, the balloon and parachute had ascended to an immense height, and Mr. Garnerin, in the basket, could scarcely be perceived. While every spectator was contemplating the grand sight before them, Mr. Garnerin cut the rope, and in an instant he was separated from the balloon, trusting his safety to

the parachute. At first, viz., before the parachute opened, he fell with great velocity ; but as soon as the parachute was expanded, which took place a few moments after, the descent became very gentle and gradual. A remarkable circumstance was observed ; namely, that the parachute, with the appendage of cords and basket soon began to vibrate like the pendulum of a clock, and the vibrations were so great, that more than once the parachute, and the basket with Mr. Garnerin, seemed to be on the same level, or quite horizontal : however, the extent of the vibrations diminished as he descended. On coming to the earth, Mr. Garnerin experienced some pretty strong shocks ; but he soon recovered his spirits, and remained without any material hurt. As soon as the parachute was separated from the balloon, the latter ascended with great rapidity, and, being of an oval form, turned itself with its longer axis into an horizontal position.

The air balloon is an hydrostatic machine that consists of a bag filled with air, so light, that the whole is specifically lighter than the common air of the atmosphere. Fig. 2. Plate X. It is, in fact, a vessel filled with a fluid which will float in another fluid—air in air. *There are two kinds of balloons ;* those raised with rarefied, and those filled with inflammable air. And the best forms for balloons are of a globe, and an egg-like figure. Large balloons, for inflammable air, must be made of silk, and varnished over, so as to be air tight. The car, or boat of a balloon, is made of wicker work covered with leather, and well varnished, or painted, and is suspended by ropes proceeding from the net which goes over the balloon. The inflammable air for filling the balloon is procured by putting a quantity of iron filings, or turnings, with some oil of vitriol diluted with water, into casks lined with lead. From the top of these casks tin tubes proceed, which unite into one that is connected with the silk tube of the balloon. As represented by Fig. 1. Plate X. Balloons cannot be made smaller than five or six feet in diameter, of oiled silk, as the weight of the material is too great for the air to buoy it up. They may be made smaller of thin stripes of bladder or other membrane, glued together.

The first principles of the science of aerostation have been long and generally known, though the application of them to practice seems to be altogether a modern discovery. The invention of balloons, though far-famed and brilliant, cannot be considered as having hitherto added much to the comfort or utility of man. The only practical purposes which it has been made to subserve, are those of aiding in meteorological inquiries, and inspecting the fortifications and reconnoitring the camp of an enemy, which could

not be approached by other means. It has been applied to this latter purpose in at least one, if not more instances, by the French engineers, during the late war. But who can undertake to assign the limits beyond which the ingenuity and the enterprise of man shall not pass ? Though this species of navigation labors under difficulties which appear at present insurmountable ; though the want of some means to control and regulate the movements of the aerial vessel is so essential as to excite a fear that it cannot be supplied ; yet who can tell what further experience and discoveries may produce ? Who can tell but another century may give rise to such improvements, that navigating the air may be as safe, as easy, and rendered subservient to as many practical purposes as navigating the ocean ? It must be acknowledged, indeed, that this is not very probable ; but things more unexpected, and more remote from our habits of thinking, have doubtless occurred.

ORNITHOLOGY.

NO. IX.

Migration of Birds. Birds without the means of conveying themselves with great swiftness from one place to another, could not easily subsist with the food which nature has provided for them, being so irregularly distributed that they are obliged to take long journeys to distant parts, in order to procure the necessary supplies. Hence one cause of those migrations which are so peculiar to the feathered race. Besides the want of food, however, two other causes may be assigned, namely, the want of a proper temperature of air, and of a convenient situation for the important work of breeding their young. Such birds as migrate to great distances are denominated *birds of passage* ; but most species are more or less so, although they do not move to places remote from their former habitations. At particular periods of the year, most birds remove from one country to another, or from the more inland districts towards the shores, or *vice versa*. The seasons of these migrations are observed with the most astonishing regularity, and punctuality ; but the secrecy, with which immense flocks take their departure, and the suddenness with which they appear, are not easily explained.

THE HOARY PARROT.

Psittacus erythacus.

'"Lord, how he nicks us" Tom More cries ;
"Lord how he nicks us" Poll replies.
Tom throws, and eyes the glittering store,
And as he throws, exclaims "Tom More."
"Tom More," the mimic bird replies.
The astonished gamesters lift their eyes,
And wondering stare and look around,
As doubtful whence proceeds the sound.'

THIS splendid and numerous genus, to which this bird belongs, is chiefly confined to the warmer regions of both continents, or within the limits of the tropics ; none being natives of Europe. Some few are found in latitudes far beyond what was supposed by Buffon, and even as far as 40° or 45° on each side of the equator. They are remarkable for their active and imitative disposition. From the peculiar form of their tongue, which in most species, is thick, flattish, rounded, and fleshy, they are enabled to articulate with greater distinctness than other birds. The upper mandible is movable ; and the feet formed for climbing, with a power of bringing forward, at pleasure, one of the hind toes. They deposite their eggs, which are generally two, in the holes of decayed trees. Though usually observed in pairs, they sometimes assemble in vast flocks. The whole genus, according to Gmelin, comprehends about 170 species.

The hoary parrot is generally preferred on account of the mildness of its disposition and of its remarkable sagacity and docility, in which it at least equals the green parrot, without the disagreeable cries. Its temples are naked and white ; and its tail cochineal or scarlet ; the head is cinerous and its cheeks are naked ; the primary quill feathers are of a brown-ash color. There are three varieties, the *red*, the *red-winged*, and the *red-variegated*, all natives of Africa, and about twenty inches long. It is sometimes called *Jaco*, from one of its most frequent sounds which it utters. It is said to have been first brought into Europe by Alexander the Great.

Most of these parrots are imported from the coast of Guinea, and come from the interior parts of Africa. They are also found at Congo, and on the south of Angola. They are very easily taught to speak, and seem fondest of imitating the voice of childen, who are also the most successful in training them. It has, indeed, been remarked by old writers that the birds most suscep-

tible of imitating the human voice are eager to listen to children, whose articulation is imperfect and unequal, and therefore more correspondent to their own. But the hoary parrot copies also the deep tones of the adult ; though the effort is laborious, and the words are less distinct. One of these birds was so completely drilled by an old sailor, that it acquired exactly his hoarse voice and cough ; and though it was afterwards committed to a young person, and was in no other company, it never forgot the lessons of its first teacher, and it was amusing to observe its transitions from a soft gracious note to its former hoarseness and coarse marine tones.

But not only has this bird a facility to articulate words, it has also an eagerness in imitating the human voice. It listens with attention, and strives to repeat ; it dwells constantly on some syllables which it has heard, and seeks to surpass every other voice by the loudness of its own. We are often surprised at its repeating words or sounds, which we never taught it. Aldrovandus gives an account of a parrot belonging to Henry VIII. which was generally kept in a room, the window of which overlooked the Thames. It had learned several phrases which it had heard the boatmen and passengers repeat. One day while playing on its perch it unfortunately fell into the river. No sooner was it apprised of the danger of its situation than it screamed loudly, *A boat ! A boat ! Twenty pounds to save me !* A boatman passing by, thought it to be a person, and precipitated himself into the water, to save, as he thought, some one drowning. But on taking it out he discovered it to be the parrot belonging to the king. He accordingly carried it to the palace of the king, demanding the twenty pounds for his reward. The story being related, the king cordially fulfilled his parrot's promise.

About forty years ago, a very essential discovery was detected at Dublin, by means of a parrot. The Lord Mayor, with his suit, enforced a law of entering, unexpectedly, all the shops of that city so as to examine the goods, weights, measures, &c. Having once visited the shop of a baker, and the weight of the loaves found just, they were well satisfied and were leaving the shop, when a parrot that was in a cage, fastened at the window, vociferated, *Look in the cabinet ! Look in the cabinet !* On hearing this the Lord Mayor and his suit entered a small room which they had overlooked, in which several loaves were found that were of unjust weight. They were immediately carried away and the baker punished.

The parrot seems to set itself tasks, and tries every day to retain its lesson. Cardan goes so far as to ascribe to it meditation

and inward reflection on what it had been taught, 'and this,' says he, 'through emulation and the love of glory.' The love of the marvellous must have had mighty influence upon this philosopher, to make him advance such absurdities. Its attention is engaged even in sleep, and, according to Marcgrave, it prattles in its dreams, which caused Aristotle to inquire whether animals hatched from eggs ever dream? Marcgrave answered, that, 'his parrot, Laura, often rose in the night and prattled half asleep.' Parrots are most capable of improvement when young; then they show more sagacity, more docility; and their memory, if early cultivated, sometimes becomes astonishing. Rhodiginus mentions a parrot which a Cardinal purchased for 100 crowns, because it recited correctly the Apostles' creed. And M. de la Borde tells us that he saw one which served as almoner on board of a vessel; it recited the sailor's prayer, then the rosary. But when it grows older, it becomes stubborn, and will hardly be taught. Olina recommends the evening, after their meal, as the proper time to instruct them; for their wants being satisfied, they are then more docile and attentive.

The education of the parrot has been compared to that of a child. At Rome, a person who trained a parrot held in his hand a small rod, with which he struck it on the head. Pliny says that its skull is very hard, and that it requires smart blows to make it feel. However, the bird to which we allude feared the rod more than a child, that had been often whipped. If after remaining perched all day, it anticipated the hour of walking out into the garden, and descended too soon (which seldom happened) threats and the sight of the rod drove it with precipitation to its roost; there it continued, but showed its impatience by flapping its wings and screaming.

Parrots of this kind not only imitate discourse, but they mimic gestures and actions. Scaliger saw one that performed the dance of the Savoyards, at the same time repeating their song. One mentioned by Madame Nadault, was pleased to hear a person sing, and, when it saw him dance, it also tried to caper, but with the worst grace imaginable, holding in its toes, and tumbling back clumsily. It was then the most cheerful; but it had also an extravagant joy, and an incessant prattling when in the state of intoxication; for all parrots love wine, particularly the Spanish and the muscadine. Even in the time of Pliny it was remarked that the fumes of that liquor gave the parrots a flow of spirits. It crept near the fire in winter, and its greatest pleasure, in that season, was to get on the chimney; and when warmed it gave many signs of its comfortable feelings. It had equal pleasure in the summer

showers ; it continued whole hours exposed, and spread its wings in order to receive the rain, and did not seek for shelter till it was wet to the skin. After it had returned to its roost, it stripped all its feathers, one after another through its bill. If the weather was dry, it liked to bathe in a cistern of water, and entered into it repeatedly, though very careful not to wet its head. But it was as averse to plunge in winter ; and if then shown a vessel of water it would run off, and even scream. Sometimes it was observed to yawn, and this was almost always the symptom of weariness. It whistled with more force and clearness than a man ; but, though it expressed many tones, it could never be taught to copy an air. It imitated perfectly the cries of wild and domestic animals, particularly the crow, which it mimicked so well, that it might have been taken for one. It seldom prattled in a room with company ; but if alone in the adjacent room, it was noisy in proportion to the loudness of the conversation which it overheard ; it seemed prompted to repeat precipitately all that it had learned. In the evening it retired of its own accord to its cage, which it shunned during the day ; there with one foot concealed in the plumage, or hooked to the bars of the cage, and its head beneath its wings, it slept until it perceived the dawn of the morning ; but it often awoke at the blaze of candles. Then it stepped down at the bottom of the cage, and sharpened its claws, using the same motion as the scratching of a hen. Sometimes it whistled or prattled in the night when exposed to light ; but in the dark it was silent and tranquil.

A very remarkable instance, is related of a parrot belonging to Mr. Braham of Brompton, which was presented to him by a lady who had bestowed great pains in teaching it to talk. This gentleman had a friend dine with him one day, and after dinner a pause having ensued in the conversation, the guest was startled by a voice proceeding from one corner of the room, calling out in a strong hearty manner, *Come Braham, give us a song.* Nothing could exceed the surprise and admiration of the company. The request being repeated, and not granted, the parrot struck up the first verse of 'God save the king,' in a clear warbling tone, aiming at the style of the singer, and sung it through. The ease with which this bird was taught, was equally surprising with the performance. The same lady taught it to accost Madame Catalani, when dining with Mr. Braham that it so alarmed her that she nearly fell from her chair. On its commencing 'Rule Britannia,' in a loud and intrepid tone, the chantress fell on her knees before the bird, expressing in terms of delight, her admira-

tion of its talents. This parrot has only been equalled in talents by one owned by Colonel O'Kelly of London. Once upon being asked to sing it replied, *I never sing on a Sunday.* 'Never mind that Poll,' the Colonel would say, 'come, give us a song.' *No excuse me, I've got a cold*, it would reply. *Don't you hear how hoarse I am?* This extraordinary bird could perform the three verses entire of 'God save the king,' words and music from beginning to end.

When the Colonel and his parrot were at Brighton, one time, the bird was asked to sing; it answered, *I can't.* Another time it left off in the middle of a tune, and said, *I have forgot.* Colonel O'Kelly continued the tune for a few notes, and the parrot took it up where the Colonel had left off. The parrot took up the bottom of a lady's frock, and said, *What a pretty foot!* The parrot seeing the family at breakfast, said, *Won't you have some breakfast, Poll?* The company mopped it a good deal, and it said, *I don't like it.* It would ask for all that it wanted and apparently with reason. It was purchased at Bristol for 100 guineas. Some persons who were desirous of exhibiting it publicly offered the Colonel 100 guineas a year for the use of it, but he was too much attached to it to accept this offer. Its death was announced in the London Gazette of the 9th of October, 1802. It was dissected by Messrs. Kennedy and Brooke who found the muscles of the larynx, which regulate the voice, considerably enlarged by exercise.

That sort of society which the parrot forms with man, is, by means of language more intimate and pleasing than what the monkey can claim from its antic imitation of our gestures and actions. If the useful and amiable qualities of the horse, or the elephant, command our attention and esteem, the singular talents of the prattling bird sometimes engage more powerfully our curiosity. It diverts and amuses; in solitude it is company; it takes part in conversation, it laughs, it breathes tender expressions, or mimics grave discourse; and its words uttered indiscriminately please by their incongruity, and sometimes excite surprise by their aptness. Willughby speaks from Clusius, of a parrot, which, when a person said to it, 'laugh, Poll, laugh,' laughed accordingly, and the instant after screamed out, *What a fool to make me laugh!* We have the account of another which grew old with its master, and shared with him the infirmities of age. Being accustomed to hear scarce anything but the words, *Je suis malade;* (I am sick;) when a person asked it, *Qu'as-tu, perroquet, qu'as-tu?*

(How d'ye Poll, how d'ye ?) *Je suis malade*, it replied, with a doleful tone, stretching itself over the fire, *Je suis malade.* This play of words without meaning is uncommonly whimsical, and though not more empty than much other talk of another class of bipeds, it is always more amusing. The parrot seems also to receive a tincture of our inclinations and manners ; it loves or it hates ; it has particular attachments, predilections, and caprices ; it is the object of its own admiration and applause ; it becomes joyous or sad ; it is melted by caresses and bills tenderly in return ; in a house of mourning, it learns to moan. The young prince Leo, son of the Emperor Basil, was condemned to death by his implacable father, whom the cries of the persons around him could not move, till, by chance, his parrot repeated several times the words, *Helas ! mon maitre Leon*, (Alas ! my master Leo,) which accents stung his barbarous heart and caused him to see his son again, and return to him all his former affection.

The power of imitating exactly articulate discourse implies in the parrot a peculiar and more perfect structure of organs ; and the accuracy of its memory, though independent of the understanding, manifests a closeness of attention and a strength of mechanical recollection which no bird possesses in so high a degree. Accordingly all the naturalists have remarked the singular form of its bill, its tongue, and its head. Its bill, round on its outside and hollow within, has in some measure, the capacity of a mouth, and allows the tongue to play freely ; and the sound, striking against the circular border of the lower mandible, is therefore modified as on a row of teeth, while the concavity of the upper mandible reflects it like the palate ; and hence it does not utter a whistling, but a full articulation. The tongue, which modulates all sounds, is proportionably larger than in man, and would be more valuable, were it not harder than flesh, and invested with a strong, horny membrane.

But this organization, though adjusted with skill, is still inferior to the structure contrived to give an easy and powerful motion to the upper mandible, and, at the same time, not to hinder its opening. The muscles are not fixed to the root, where they should have exerted no force ; nor to the sides, where they would have closed the aperture. Nature has adopted a different plan ; at the bottom of the bill are fixed two bones, which, extending on both sides, and under the cheeks, form a continuation of it, similar in form to the *peterygoid* bones in man, except that their hinder extremity is not concreted into another bone, but loose. Thick layers of muscles, sent off from the back of the head, and inserted in these bones, move them and the bill.

The bill of the parrot is very strong, with which it very easily cracks nuts of the red fruits ; it gnaws the wood, and even bends or wrenches the bars of its cage, if they be slender, or if it be tired of confinement. It uses its bill, oftener than its claws, in climbing and suspending itself ; it also holds by the bill in descending, as if it were a third foot, which steadies its motion ; it also serves to break its fall. It is a second organ of touch, and is equally useful with its toes in scrambling and clenching.

The mobility of its upper mandible gives it a power which no other birds have, of chewing its food. In those, whether of the granivorous or carnivorous tribes, the bill is like a hand which throws the food into the gizzard, or an arm which splits or tears it. The parrot seizes the piece sideways, and gnaws deliberately. The lower mandible has little motion, but that from right to left is most perceptible ; and this is often performed when the bird is not eating, which has made it be supposed to ruminate. In such cases it probably only whets the edge of the mandible, with which it cuts and bites its aliments.

The parrot discovers hardly any choice in its food ; it lives in its native country on almost every kind of fruit or grain. In the domestic state, it eats whatever is presented ; but flesh, which it would rather prefer is extremely hurtful to it, and occasions an unnatural longing which prompts it to suck and gnaw its feathers, and pluck them one by one from every part that its bill can reach. This species of parrot is particularly subject to that disease ; it tears the feathers from its body, and even from its beautiful tail, which never afterwards recovers the same bright red as at first.

Sometimes after moulting, this parrot is observed to become marbled with white and rose color ; occasioned either by some distemper, or by advanced age.

It is uncommon for parrots to propagate in our temperate climates ; but they frequently lay addled eggs. There are some instances, however, of parrots being reared in France. M. de la Pigeonier had a pair in the town of Marmande in Agenois, which hatched regularly each spring for five or six years, and their young lived and were educated by their parents. Each hatch consisted of four eggs, three of which succeeded. They were shut up in a room with nothing but a barrel open at the top and filled with saw dust.

CONCHOLOGY.

NO. VIII.

Of the methods of fishing and collecting shells. Land shells are immediately within the reach of the hand of the collector, as well as many sea and river shells, which inhabit shallow waters, or attach themselves to rocks or marine plants on the shores of the ocean. These shells which are at moderate depths in the sea, are to be collected by dredging. But in whatever way shells are found, those are always to be preferred which still contain the living animal; for then, not only some information may be obtained with regard to its structure and natural history, but the shells themselves are in all their natural beauty, and the full glow of their colors. Those shells too, should be preferred, which are procured from the deeper parts of the ocean, because they have then arrived at the largest size, and are in the greatest perfection. But these are beyond the reach of man, and are only accidentally found on the shores after storms, or attached to sea weeds which have been torn from the rocks by the agitation of the waves.

When shells are found with the animal alive, the method recommended to destroy it and separate it entirely from the shell, is to boil it in water for a very short time, and after allowing it to cool gradually, and to lay it in cold water till it is cleaned. By this process, the attachment between the shell and the animal is destroyed, and the latter, which has become hard and contracted, is easily picked out from its covering. The shell, after this treatment, is ready to be placed in the cabinet, or to be polished in a way we shall hereafter describe, according to the state in which it is found, or the views of the collector.

As the pearl has been held in high estimation in all ages of the world, and as it is an important object of commerce in many countries, the history of the pearl fishery, or of those shell fish which produce the pearl, cannot fail to be interesting.

In different parts of Britian the pearl fishery has been carried on to a considerable extent; and in some places it has been reckoned of such value, that governments have granted the right of fishing to individuals by patent. By a grant of this kind, Sir John Hawkins obtained the privilege of fishing for pearls in the river Irt in Cumberland; and Buchan of Auchmacoy seems to have held, by a similar right, the sole privilege of the pearl fishery near the mouth of river Ythan in Aberdeenshire; for it appears that this grant was resumed by government in 1633, in the first parliament of

Charles I. In the same river, at the distance of 10 miles from the sea, a successful fishery of pearls has been frequently carried on ; and a few years ago, in the river Cluny in the same county, a Jew employed a number of people to collect the muscles which contained them, and some large and valuable pearls were found. Some years ago, in the river Teath in Perthshire, the pearls which were got brought about a 100*l.* sterling to those employed in searching for them, in the course of one season. It was observed, that those muscles only which were crooked and distorted yielded pearls. The method which has been practised on this river for fishing the pearl muscle, is the following. The fisherman provides himself with an instrument formed of two iron plates or spoons, having something the shape of the muscle. Each of these is attached to an elastic handle of the same metal, terminating in an open tube, which is fixed to the end of a long wooden handle. The concave sides of the plates approach each other, and are kept in close contact by the elasticity of the handles. With this instrument the fisherman enters the water, and directs his course to those places which he supposes are resorted to by the muscles. These he discovers with his feet, and having found one, he presses the instrument upon it, the plates or valves of which, in consequence of the elasticity of the handles separate, and then grasp it firmly. In this way he can detach it from the place to which it adheres, and bring it to the surface of the water. The pearl muscle is a native of many other rivers of Scotland, as of the Esk in Forfarshire, where a pearl was found of the size of a pistol bullet, and sold for 4*l.* sterling ; but of the Devon in Clackmannanshire, the Clyde, and of Lock Ken in Galloway, where it is said great numbers of pearls are fished in dry summers, many of which sell from one shilling to one guinea. But the greatest pearl fishery which has ever been established in Scotland, of which there is any record, is that of the river Tay, several years ago. The pearl muscle is found in every part of this river, from its source in Lock Tay, to its junction with the sea. In different parts of the river, but particularly in the vicinity of Perth, we are informed, that not less than 11,000*l.* worth of pearls were sent to London during the year 1761 and 1764. They were sold from 10 shillings to 1 pound 16 shillings per ounce. About this time one pearl was found which weighed 33 grains. This fishery, however, as well as the pearl fishery in other rivers of Scotland, seems to be greatly exhausted, and very probably, as it has been supposed, from the improvident avarice of the undertakers, not allowing the animal to arrive at that age which seems to be necessary for the production of the pearl.

But the pearl fishery of the warmer climates, in different parts of the East Indies, in the gulf of Persia, and the Red Sea, and particularly that which is annually carried on in the bay of Condatchy, in the island of Ceylon, is by far the most extensive and most important of any in the world.

The following account of the pearl fishery at Ceylon is recorded in the Asiatic Journal of the year 1800.

'The person who formed the pearl fishery at Ceylon, last year, was a Tamu merchant, who for the privilege of fishing with more than the usual numbers of donies or boats, paid between two and three hundred thousand porto novo pagodas,* a sum nearly double the usual rent. His excellency the honorable Mr. North, by the last ships from Ceylon, has transmitted a very minute detail of the fishery in all its stages, some of which are truly singular and remarkable. It appears that the fear of sharks is the cause of a great deal of interruption to the fishery, the divers being extremely timid and superstitious; every one of them, even the most expert, entertain a dread of sharks, and will not on any account descend until the conjuror has performed his ceremonies. This prejudice is so deeply rooted in their minds, that the government was obliged to keep two such conjurors in their pay, to remove the fears of the divers. The manner of the enchanting consists of a number of prayers learned by heart, that nobody, probably not even the conjuror himself, understands, which he, standing on the shore, continues muttering and grumbling from sunrise until the boats return. During this period, they are obliged to abstain from food and sleep, otherwise their prayers would be of no avail; they are, however, allowed to drink, which privilege they indulge in a high degree, and are frequently so giddy as to be rendered very unfit for devotion. Some of these conjurors accompany the divers in their boats, which pleases them very much, as they have their protectors near at hand. Nevertheless, I was told, said Mr. North, that in one of the preceding fisheries, a diver lost his leg by a shark; and when the head conjuror was called to an account for the accident, he replied, that an old witch had just come from the coast, who, from envy and malice, had caused this disaster by a counter conjuration, which made fruitless his skill, and which he was informed of too late; but he afterwards showed his superiority, by enchanting the sharks so effectually, that though they appeared to most of the divers, they were unable to open their mouths. During my stay, continues Mr. North, at Condatchy, no accident of this kind happened. If a shark is seen, the divers

* About $444,400.

instantly make a signal, which on perceiving, all the boats return immediately. A diver who trod upon a hammer oyster, and was somewhat wounded, thought he was bit by a shark; consequently made the usual signal, which caused all the boats to return; for which mistake he was afterwards punished. The largest and most perfect pearl taken last season, was about the size of a small pistol bullet.'

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. X.

CHEMICAL, AND MEDICAL PROPERTIES OF SILK. 'The coloring matter, which more or less tinges silk with a golden hue, resides in the gum which the silkworm produces in such abundance with the filament, and which exercises so important an agency in facilitating all the preliminary processes of its manufacture.

'If the cocoons be immersed in hot water a portion of this gummy or resinous substance will be dissolved, and will impart to the water a light amber color. If alcohol be employed as the solvent a much larger portion of this matter will be extracted from the silk, and a tincture formed, which will retain its color even after it has been exposed to the rays of the sun for a much longer time than would suffice to bleach the silk itself.

'The knowledge of the fact that this coloring matter has a greater affinity for alcohol than for water led Mons. Baume to adopt the following process for bleaching silk:—

'A stone-ware vessel, of a nearly conical form, and capable of holding about twelve gallons, was provided, having a large opening at the top, and a smaller one, about an inch in diameter, at the bottom. Vessels made of common pottery ware could not be used for the purpose, as they would speedily have been rendered unserviceable by the acid employed in the bleaching. From the same cause, the stone ware even proved to be not very durable. All roughnesses on the inside surface of the vessel, which could have broken the threads of silk, were carefully rubbed down with pumice stone. The small aperture at bottom was closed by a cork, through the centre of which a glass tube, of a quarter of an inch diameter, was passed, and, except at the time when it

was required to draw off the liquid contents of the vessel, this tube also was kept closed by a cork.

'Six pounds of yellow raw silk were then disposed in the stone ware vessel, and upon this was poured a mixture previously made of forty-eight pounds of alcohol (specific gravity 0·867) with twelve ounces of very pure muriatic acid (specific gravity 1·114.) The vessel was then completely closed, and the whole was left in digestion until the liquor, which at first assumed a green color, passed to that of a dusky brown : this usually happened in the course of twenty-four hours. The acidulated spirit was then drawn off by means of the glass tube, and clean spirit of wine was poured continually over the silk, until the liquid passed off perfectly colorless. The silk was then left to drain without being otherwise disturbed. A mixture of the same quantity of spirit with muriatic acid was then again poured upon the silk, which, after being exposed to its action for a period somewhat longer than the first digestion, proved to be perfectly and brilliantly white. The time required for this second application of acidulated spirit was of less or greater duration, according to the temperature, and the original quality of the silk. Baume found that the bleaching was much more readily accomplished when the cocoons had not been previously baked, for the destruction of the chrysalides. The second dose of liquid was but slightly tinged when drawn off ; and if another portion of acid, equal to half the quantity originally used, were added to it, the mixture could properly be used for the first digestion of a second quantity of the raw material.

'A further washing of the silk then ensued, by pouring upon it forty-eight pounds of pure unacidulated spirit of wine, which was drawn off in the course of the following day.

'To recover the quantity of spirit absorbed by the silk, and which was equal to its own weight, small quantities of water were sprinkled over it from time to time, and this process was continued until the liquid, which drained off through the glass tube, had no perceptible strength. Notwithstanding these repeated washings, the silk still retained a portion of muriatic acid, which made it harsh to the touch, and if left in it, would, after a time, have injured its fibre : it was therefore placed in a coarse woolen bag ; and this, being inclosed in a basket, was left for several hours in a stream of running water, which effectually washed out the acid.

'Pieces of manufactured silk, and even made-up garments, have been successfully bleached by this process.

'The spirit may be recovered by saturating the mingled acid with potass, or lime, and then distilling the spirit in a copper

alembic. Mons. Baume says that silk may be thus made to rival or even to surpass in whiteness and lustre the finest specimens from Nankin.

'The revenue regulations, and the dearness of spirit, make the above process impracticable in England, where the usual method of bleaching raw silk is to immerse it in a boiling solution of good soap in river water. After boiling for two or three hours the silk is taken out, beaten, and then rinsed in cold water; when this has been sufficiently performed, it is slightly wrung, then put into cold soap and water, tinged with a minute portion of indigo, and again boiled. On removing the silk from this second water, it is wrung as dry as possible with the assistance of wooden pegs, and is then well shaken to separate the threads: after this it is suspended in a kind of stove constructed for the purpose, which contains sulphur in a state of combustion; the fumes arising from this give the last degree of whiteness to the silk, and the process is completed.

'Silk is powerfully acted upon by nitric acid. If two drachms of this acid are mixed with a pint of alcohol, and silk, either raw or bleached, be immersed in it, and kept in digestion exposed to a moderate heat for twenty-four hours, the silk becomes of a dull yellowish brown, which, after it has been washed with soap, rinsed, and dried, turns to a fine golden yellow color, which is very permanent. Concentrated nitric acid being distilled of silk, and the remaining liquor partially evaporated, oxalic acid is obtained: if the evaporation be pursued still farther, the residue will yield, together with a small portion more of oxalic acid, a quantity of yellow crystals, not in the slightest degree acid, but intensely bitter, and which stain the skin of a deep yellow color, not easily removed. This curious substance was discovered by Welter, and was called by him the "bitter principle." He supposed that its production always results from the action of nitric acid on animal matter. These crystals, when examined through a magnifying glass, appear to be composed of truncated octahedrons.

'If the remaining liquor be previously saturated with potass and evaporated, another yellow silky salt separates, which detonates on burning coals like nitre, and appears to be a triple combination of the before mentioned bitter substance with nitrate of potass.

'The water wherein the cocoons are placed to prepare them for reeling, quickly acquires from them so much of the resinous matter as to be more viscid than the strongest soap lather. Chappe found that he could inflate this water into bubbles or

small balloons, which were far more permanent than any formed of soap and water, and which equally exhibited the prismatic colors. The texture of these bladders was so tenacious, as to render them impervious to the most subtle gas. Chappe filled several of them, whose diameter did not exceed three inches, with hydrogen gas, and the little air balloons remained unbroken and floating in his apartment for considerably more than twenty-four hours. All cocoons are not sufficiently glutinous for this purpose ; with those which are of a very deep yellow the experiment will not succeed : such are supposed to be produced by the worm in a peculiar state of disease, which state is yet by no means uncommon.

'According to Westrum, silk, when acted upon by chlorine, either in the gaseous form or diluted in water, instead of being bleached, as cotton or linen would be, always becomes of a yellow color, and loses part of its solidity. The caustic alkalies corrode and dissolve silk, which give by distillation the results usual with animal substances.

'Neumann found that but few materials afforded an equal quantity of volatile alkali. Tournefort observes that it contains more than hartshorn, as he obtained from fifteen ounces of silk two drachms of volatile salt : this, which was called the spirit of raw silk, when rectified with some essential oil, was the medicine formerly celebrated under the name of "Guttæ Anglicanæ," or English drops. The volatile alkali obtained from silk was then supposed to be of a different nature from that contained in any other substance, and it consequently was held to possess different virtues peculiar to itself. So salt of tartar, and sub-carbonate of potass, were for a long time considered to be, and were, used as two separate substances. The chemical philosopher had not then learned to generalize, and could not understand that the same substance, differing in no one particular as to its nature and properties, could be obtained from many apparently wholly dissimilar bodies.

'Before the discoveries of chemistry had arrested the fanciful flights and annihilated the quaint distinctions of the druggist, his catalogue presented a curious nomenclature, which is now acknowledged to have been founded on ignorance and prejudice. The light of science has since pierced the veil, and has revealed many of the laws of nature in all the beautiful simplicity of their elements ; dispelling much of the complicated mystery and vague obscurity which then enveloped the ill-understood practice of pharmacy.

'A silk covering of the texture of a common handkerchief is

said to possess the peculiar property of resisting the noxious influence and of neutralizing the effects of malaria. If, as is supposed, the poisonous matter is received into the system through the lungs, it may not be difficult to account for the action of this very simple preventive : it is well known that such is the nature of malaria poison, that it is easily decomposed by even feeble chemical agents. Now, it is probable that the heated air proceeding from the lungs may form an atmosphere within the veil of silk, of power sufficient to decompose the miasma in its passage to the mouth ; although it may be equally true that the texture of the silk covering may act mechanically as a non-conductor, and prove an impediment to the transmission of the deleterious substance.

'We learn from Pomet's history of drugs, that silk was in his time used as a medicine, by reducing the pure part of the cocoon into a powder. His volume contains many copious directions for preparing this powder, and for duly and carefully separating the chrysalis from the part which he considered medicinal. Silk thus prepared has, as affirmed, "the virtues of cleansing the blood, making the spirits brisk, and the heart pleasant." Lemmery, the editor and commentator of Pomet, adds, that the silkworm itself likewise possesses medicinal properties. According to its information, silkworms that had been dried into a powder and applied upon the head, which should be previously shaved for the reception of this plaster, were esteemed extremely efficacious in curing the vertigo.

'The imperishable nature of silk, even under circumstances peculiarly unfavorable to the preservation of animal substances, forms another of its qualities which is deserving of remark. Some years ago, the sexton of the parish of Falkirk, in Stirlingshire, upon opening a grave in the churchyard, found a riband wrapped about the bone of an arm, and which, being washed, was found to be entire, and to have suffered no injury, although it had lain for more than eight years in the earth, and had been in contact with a body which had passed through every stage of putrefaction, until it was reduced to its kindred dust.'

THE YOUNG LADY'S BOOK.

NEW EDITION.

The Young Lady's Book : A Manual of Elegant Recreations, Exercises, and Pursuits. Third American Edition. Boston : A Bowen, and Carter, Hendee and Co. 12 mo., 1832.

[WHEN we say that this is the handsomest book ever printed in America, we will assure our readers that we speak of one of its slightest merits. The choice selection of its subjects, the extreme neatness and just execution of its embellishments, and the purity and simplicity of its style, render it alike useful, instructive, and delightful. It is truly said of the English copy, by the London Literary Gazette, that, 'a few years ago, all the talents of England could not have produced such a work.' It is no less calculated to be valuable to the student of nature, than to be a distinct chart of the useful and ornamental departments of a lady's education. 'Instead of being an *Annual* flower, to bloom and be forgotten, it aspires to be a PERENNIAL, an *Evergreen*, that shall form a suitable memorial for all seasons and all times.' The following extract will perhaps better show the object of the work and imperfectly serve as a specimen.]

THE CABINET COUNCIL.

Seated in front of a splendid specimen of the ingenuity of the Chinese,—a gilt and richly inlaid table, covered with a variety of beautiful minerals, shells, and articles of virtù,—the Editor, after having been duly announced by Prudence, her bower-woman, found his cousin Penelope, on his entrance into Lady Mary's brilliant boudoir. Lady Mary was standing attired for a ride, near her fair kinswoman ; and Aunt Elinor, the very pearl of the ancient sisterhood of spinsters, entered the apartment before the usual greetings were concluded.

'Your cousin, young ladies,' said Aunt Elinor, 'wishes to look round Lady Mary's boudoir again, to see if anything has escaped his notice.'

This was a very mysterious announcement. Lady Mary, after looking earnestly, first at her aunt, and then at Penelope, as if she were desirous of reading an explanation in their eyes, exclaimed: 'Escaped notice, aunt! I cannot conceive what you mean.'

'Why, it would seem, child,' was the old lady's reply, 'that the arrangement and decorations of your boudoir, have, in some degree attracted his admiration; although for my own part to speak candidly,—and you know I love you equally,—Penelope's seems to me by far the more preferable of the two; indeed, with one or two alterations, it might be pronounced perfect.'

'The fault of Penelope's boudoir,' said Lady Mary, 'is superlative neatness: it looks as prim as herself; casting a glance round it, your first feeling of admiration at its order is subdued in an instant, by a disagreeable conviction of the pains it must have cost her to drill her little squadrons of embellishments so as to produce such an effect. My dear Pen! you may smile, but you are positively as precise as a mathematician: old Euclid seems to have been school master to the Graces who preside at your toilet. But would you believe it?' added the lively Lady Mary, turning to the Editor, 'notwithstanding she dresses in drab, and looks demure, cousin Penelope, Sir, I can assure you, is as brilliant as possible on a birthday; for when she does condescend to be splendid, I must confess, that few, if any of us, eclipse her.'

'Yet allow me to remark,' said Penelope, 'that the rich and profuse negligence which reigns in your boudoir is the result of thrice the toil that I have employed in decorating mine.'

'That is true enough, Penelope,' said Lady Mary, while a slight blush tinged her cheek; 'but the toil you speak of is not apparent. I look upon my boudoir (pardon the comparison) as upon a fine picture, in which those splendid dashes of light, which charm us,—those fine touches of brilliant beauty that seem to fall from a mass of foliage to gild the bold edge of a ruin, and finally descend to illuminate and ennoble a daisy,—appear to have been the work of a moment;'—

'Or, to help you with a more high-flown simile, Lady Mary,' said her cousin, who was now turning over a portfolio of engravings, 'they seem to have been produced by the Muse of Painting, at a single dash of her brush newly dipped in the fountain of light!'

'And yet,' continued Lady Mary, smiling at Penelope's simile 'they are, in fact, produced only by labor, both of the mind and the hand. This apparent carelessness of arrangement has, I admit, cost me considerable pains; but everybody admires the ef-

fect, because the art which produced it is concealed. Here, for instance, in this recess, is a beautiful cabinet picture,—a charming landscape, partly veiled, but not hidden, by a common, but, in my opinion, remarkably elegant creeping-plant, which extends far enough round the corner to twine about the carved ebony frame, and festoon the polished surface of an old-fashioned glass, which I prize because it was my grandmamma's : here again, you may perceive it wandering downward, and encircling a fossil ; on the other side of the window it has attached its tendrils to a tall and stately exotic, and droops from its topmost flower to garland a Greek vase. Now, although this appears to be all the result of pure accident, Penelope, who is smiling at my comparison, will tell you 'twas I that did it. And do not imagine, I pray, that everything here is in such a chaotic jumble as to be inconvenient ; there is, in fact, order in its seeming confusion ; I have a clue to the labyrinth, and can find a book or a butterfly in my boudoir quite as soon as Miss Penelope can in hers. Candidly speaking, which do you prefer?'

'To me,' replied the Editor, to whom this question was addressed, 'they appear to be exquisite specimens of the different styles to which they belong. Like every other boudoir that I have seen (although all bear a faint sort of family resemblance to each other,) each is apparently embellished according to the judgment of its fair owner, of whose taste and habits it might be taken as a symbol.'

'That is precisely as I think,' remarked Penelope.

'Then, my dear,' replied Lady Mary, 'notwithstanding your reputed wisdom, I must respectfully submit,—as I am told the lawyers say, when they contradict the court,—that you are partially in error. Of a lady's taste, her boudoir may sometimes, but not always, be a visible criterion. She may possess the taste of one of those select few, on whom Apollo has shaken a dew-drop from his laurel, and yet have as little means of gratifying it as poor Cinderella, before she had a little fairy glass-bower for a shoemaker: she may also be gifted with pure taste in an equal degree, and have a kind Crœsus for a relative to allow her an unlimited account at Coutts's and yet be possessed with a sister sprite to that which nestled in the heart of an Elwes or a Dancer. That a boudoir is not always a proof of the habits of its owner, I positively confess mine to be an instance:—those specimens of minerals are very rare and valuable,—at least, so says Penelope,—but they never struck me as being beautiful, and she knows I am little more acquainted with Mineralogy, than with the grammar of the Moslems. But to waive the question as to

the superiority of Penelope's boudoir to mine, or mine to hers, allow me to ask, why my brave cousin, who sits smiling at our debate, is so anxious that nothing in my pet apartment should escape his notice?'

'I will endeavor to satisfy you on that point,' said the Editor. 'About two years ago, while seated in this identical chair, I conceived the idea of producing and publishing a work that should be deemed worthy of the acceptance of every young lady in the kingdom.'—

'I hope you do not intend to inflict another Annual upon us,' said Penelope.

'By no means,' replied the Editor; 'so far from following the beautiful, but much-beaten track of my predecessors, it is my intention to offer the present-giving public PERENNIAL,—an *evergreen,* that will not be merely looked at, and laid aside forever, but will attract notice and merit attention at all times and at all seasons;—not such a mere boquet of flowers as, however, rare or beautiful, seldom tempt their warmest admirers to a second inspection, and which are always dethroned, even if they hold their ephemeral sway for a year, by other blossoms, presented by the same hands, at the return of the book-budding season;'—

'But,' interrupted Aunt Elinor, with more enthusiasm than usually beamed on her placid countenance,—'to drop my nephew's flowery metaphors,—a volume which, although rich in beautiful embellishments, shall be so useful and instructive, as well as amusing, that it will, in all probability, be as often in the hands of every young lady of sense who possesses it, three or four years hence, as within a month after its publication.'

'That is exactly my meaning,' said the Editor, looking gratefully towards Aunt Elinor; 'and I sincerely trust I have been fortunate enough to accomplish so desirable an object.'

'And pray, cousin,' inquired Penelope, 'what is the book to contain?'

'If you require a view of the contents,' replied the Editor, 'I have only to say, look around you!—Lady Mary's boudoir would form a very good index to the volume, and present a capital epitome of a young lady's best pursuits, exercises, and recreations. Flora has here a number of living representatives; Gnomes, in bronze, seem to bend beneath the weight of the minerals which are placed upon their shoulders; a sea-maid with her conch, illumines the apartment when 'Night hath drawn her vail o'er earth and sea;' the insect world is represented by groups of Oriental beetles, and splendid butterflies; the humming-bird is here, with many other of his fellow-tenants of the air, making all

around them look dim by the metallic lustre of their plumage :—all these remind me of sciences which are applicable to the study of young ladies;—I have made a 'prief of it in my note-book;' and introductory papers on Botany, Mineralogy, Conchology, Ornithology, and Entomology, have been the consequence.'

'Then there is some probability,—as, of course, I shall have the work,' said Lady Mary, 'that ere long I may know something of two sciences, of which, although they are represented in my boudoir, I am now altogether ignorant.'

'One of them, I know,' said Penelope, 'is Mineralogy ; and I must confess it surprises me that it should never have attracted your favorable notice. If minerals were only to be seen in mines,' she continued, 'it would be a different case; but they have, for years, been mutely pleading to you in their own behalf: they meet your view on all sides; many of them even in a native state. They contribute essentially to our comfort, and add to our splendor: they embellish the lofty domes and high places which are the pride of our country, and passively contribute to its defence: they adorn our parlors and our persons: some of them are almost indispensable even to the cottager's wife; while others sit enthroned on the brows of royal beauty, exceeding all beneath 'the Lady Luna and her silvery train' in brilliancy, and equalling the chaplet with which Flora would bedeck herself, in richness and variety of hue ; and although they possess not the fragrance of the rose-bud, nor the graceful form of the lily, their durability exalts them to a higher value than that of the most lovely flower that basks in the noon-tide ray, or blooms in the shade. The snowdrop melts away almost as soon as the white mantle that covers its birth-place ; the violet delights our eye in the morning, and is withered by sunset ; the queen of flowers endures but for a brief period, and there are few of her subjects hardy enough to bear the scorching glance of a summer sun, and the chill breath of winter: but a diamond endures for ages, and is brilliant and beautiful at all times and in all seasons; the ruby outlives a thousand generations of roses; and the holly and the laurel are ephemeral, compared with the emerald.'

Lady Mary was rather surprised at the unusual enthusiasm of Penelope; without, however, waiting to make any remark upon her cousin's poetical style of speaking, she placed her hand upon Penelope's bracelet, and begged to interrupt her oration in favor of the mineral world for a few moments, by offering a short plea on behalf of the subjects of Flora. 'You must, I am sure,' said she, 'however warmly you may be attached to your pet science, allow that flowers have one great advantage over minerals;—the

latter are dead, but flowers live. We can sow their seeds, and watch them breaking through the earth, and rear them into beauty and perfection. We have sympathies in their favor: they languish beneath intense heat, and are chilled by the cold easterly blast; they flourish for a time, and then fade away like ourselves: but the gem dies not: its duration, for ought we know, may reach to the extent of time. Some may admire it for its beauty, and others doat upon or covet it for its value ; but it has never that pure hold on our affection, which the flower, we nourish possesses. Besides, there are thousands of delightful associations connected with flowers and shrubs. The imagination of the painter, or the poet, never conceived a more exquisite picture of beauty than the dove of the ark gliding towards Ararat with the olive-branch, over the still, solitary, measureless surface of the waters, gazing down upon its own shadow, and listening to the music made by its own wings. Lectures on history, manners, or even mythology, might be given with no text but a leaf or a flower. With a white and red rose before him, the historian might comment upon the old English wars between the houses of York and Lancaster; a boquet of Eastern flowers would recall to the traveller's memory some dark-eyed maiden of Persia, whom he had seen committing to the charge of a pigeon,—swiftest of messengers,—a billet composed of buds,—the accepted symbols, in her father-land, of hope, joy, grief, reproach, or affection ; and the humble daisy of the mead might give a hint to those learned in antique lore, to depict Proserpine gathering flowers in the vales of Sicily, unconscious of the approach of gloomy Dis : a good homily, too, might be written upon a violet.'

'What you have said is very true, Lady Mary,' replied her cousin ; 'but the mineral has also its associations : it possesses a greater individuality of interest, in this respect, than the flower. You may show me a rose of the same species as those worn by the princely Plantagenets, but it is not the same rose. The flower perishes before the hand that gathers it is cold ; but the mineral's duration affords scope for the imagination to roam as far as the border-land of the probable and the possible. The wise may smile at me for indulging the feeling, or making the confession but I have often detected something akin to awe creeping over me when gazing upon a gem :—it may have sparkled on the arm of Cleopatra, as she sailed down the Cydnus ; or enriched the crown of Semiramis, or the girdle of a Ptolemy ; or been worn by the Theban mummy that was embalmed three thousand years ago, and after that immensity of time, is brought to revisit the glimpses of the moon, to be gazed and wondered at by those who

have been, comparatively speaking, but just ushered into life. It may be, I have thought, when looking at an amethyst, that thou wert once contemplated by Pliny, and wilt be looked upon, a thousand years hence, by some one abiding in what are now the wilds of the New World, but then the heart of a populous city, and the mistress of the earth, with feelings precisely similar to my own! And what a harvest of rich recollections may be gathered from the sight of a suit of family diamonds! At how many birth-days have they been admired! How many brows have they adorned! The hoops and furbelows with which they were once accompanied; the myriads of fashions,—nay, whole generations of their wearers,—have passed away and are forgotten; their names are only found on musty parchments, pedigrees, or monuments: but the diamonds are the same; brilliant as ever, they mock their transient wearers by their durability,—sparkling on the bosom of the Lady Jane of to-day, as they will, in all probability, sparkle on the brow, the wrist, or the zone, of some equally young and admired Lady Jane, some centuries to come. They have been in a side-box when Garrick played Richard, and will be worn, it may be, at the performance of some Cherokee Roscius a thousand years hence.'

'Why Pen!' said Lady Mary, almost staring at her cousin, 'I never heard you talk at this rate, and in this style, before. What has possessed you?'

'Simply a desire to make a fellow-student. I have merely adopted your own manner, because I thought it would be more likely to attract you, than the usual plain hundrum level of my discourse. You look as though you were astonished, that your Cousin Pen could mount the stilts, or rise into heroics; but, believe me, coz, 'an thou'lt mouth, I'll rant as well as thou.'

'The other science,' said the Editor, 'to which, I imagine, Lady Mary alluded, is Ornithology. It is certainly my intention to admit the class-mates of the humming-bird, with those of the nautilus, the butterfly, the emerald, and the rose. The mineral and vegetable kingdoms have each been so finely advocated, that it would be superfluous in me to utter a sentence in their favor. You are both, I know, very much attached to Conchology and Entomology. The degree of eloquence either of you might display, in defence of those sciences, may be easily imagined, on considering for a moment the fertility of the theme. There is a fine halo of poetry in the imagination, round the conch, the nautilus, and the pearls, as well as the lily and the amethyst; and it cannot be denied that the insect world is endowed with as much beauty as, and more interest than, either the rose or the diamond.

If Lady Mary ground her strongest plea in favor of flowers on their vitality, how much more powerfully may we, on the same score, advocate the cause of the butterfly! There is nothing so admirable in the operations of nature, 'within the bourne of Flora's reign,' as the metamorphosis of an insect—its gradual development and advance through various stages of existence, until it emerges from a tomb constructed by itself, endowed for the first time with the means of soaring into the air. And what can the mineral or vegetable kingdoms afford so attractive to the inquiring mind, as the singular habits and instincts of many insects, and of several of the animals, which, like 'the hermits of fairy-land, abide in pearly grottoes on the shores of Oceanus?'—but notwithstanding the potent claims on our attention of the insect, the shell, the mineral, and the flower, it is a matter of doubt whether any of them be more worthy of our investigation than birds. The forms of an immense number of birds are remarkably graceful; the plumage of many exhibit tints as rich, brilliant, and diversified, as can be found in the entire range of animated nature; their structure is various, and, in all cases, admirably well adapted to their wants and habits. Their utility to mankind is obvious: they afford us articles of ornament as well as of use: the plume of the ostrich is associated, at the toilet, with the flower, the gem, the pearl, and the produce of the silkworm; to neither of which are we indebted for such important benefits as have been afforded us by the quill of the goose. The nidification of many birds is quite as ingenuous as that of insects; their migration have attracted the notice of philosophers for ages past; and their familiarity in a domestic state, and the affection they display toward their nestlings, elevate them, as objects of human interest, above all the other classes of creation which we have noticed.'

'Your remarks,' said Aunt Elinor, 'appear to me to be very correct: and you act discreetly in suffering Ornithology to occupy a niche by the side of her sister sciences. Thus far would I go, but no farther.'

L'OVERTURE.

Here, in this classic bower,—the Muse's home,—
 Fair Science sits upon a throne empearl'd;
And, at the waving of her wand, a Gnome
 Reveals the treasures of the mineral world.

Her silver bow Latona's daughter bends;
  Young Music, heav'nly maid! assumes the lyre;
Terpsichore her glad assistance lends;
  And Painting's charms the youthful soul inspire.

Here, Flora reasons on a budding rose;
  Lorn Philomel a learned treatise sings;
While purple moths their graceful forms disclose,
  With lectures woven on their gorgeous wings.

Minerva and the Graces here display
  The charms of taste with wisdom's lore combin'd;
And willing Sylphs their various arts essay,
  To raise, improve, and gratify the mind.

SPURZHEIM'S PHRENOLOGY.

[Outlines of Phrenology, by G. Spurzheim, M. D. of the Universities of Vienna and Paris, and Licentiate of the Royal College of Physicians of London. Being also a manual of Reference for the marked Bust. Boston: Marsh, Capen and Lyon. 18mo. pp. 96. 1832.

This little book contains a brief but comprehensive view of the elementary notions of Phrenology and will impart much information to those who are in pursuit of the science, particularly those who attend the Author's Lectures.

We are happy to understand that some of his most important works will shortly be published by Marsh, Capen & Lyon, in this City.

He has also, caused to be prepared, at a moderate price, some casts and busts, illustrative of the science which will greatly facilitate the student in his progress.

His lectures are numerously and well attended by the most learned portion of our community, and have, as yet, been highly instructive and satisfactory. We shall in some future number endeavor to make an abstract of them with some remarks from other sources.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR AUGUST, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inches.*
1	66	65	64	30.13	30.15	30.17	Fair	Cloudy	Cloudy	S. W.	N. E.	S. W.	0.16
2	64	74	70	30.18	30.18	30.18	Cloudy	Fair	Fair	S. W.	E.	S. W.	
3	66	80	71	30.18	30.12	30.10	Rain	Fair	Fair	S. W.	S. W.	S. W.	0.68
4	64	84	76	30.09	30.05	30.05	Fair	Cloudy	Fair	S. W.	N. W.	S. W.	
5	75	81	73	30.06	30.08	30.08	Cloudy	Rain	Cloudy	S. W.	S. W.	S. W.	0.15
6	68	76	66	30.12	30.12	30.12	Cloudy	Fair	Fair	N. W.	E.	N. W.	0.73
7	66	82	73	30.12	30.12	30.05	Cloudy	Fair	Rain	S. W.	S. W.	S. W.	
8	71	82	74	29.95	29.95	29.92	Cloudy	Rain .	Rain	S. W.	S. W.	S. W.	0.19
9	72	72	68	29.90	29.90	29.90	Cloudy	Fair	Rain	S. W.	N. E.	S. W.	0.09
10	66	78	69	29.68	29.79	29.99	Rain	Fair	Fair	N. E.	S. W.	S. W.	1.57
11	62	74	64	30.12	30.20	30.35	Fair	Fair	Fair	N. W.	E.	N. W.	
12	61	80	70	30.28	30.28	30.25	Fair	Fair	Fair	S. W.	S. W.	S. W.	
13	69	83	70	30.28	30.28	30.27	Fair	Fair	Fair	S. W	S. W.	S. W.	
14	70	87	75	30.20	30.18	30.13	Fair	Fair	Fair	S. W.	S. W.	S. W.	
15	72	86	77	30.10	30.02	29.79	Fair	Cloudy	Fair	S. W.	S. W.	S. W.	
16	75	70	62	29.92	30.00	30.09	Cloudy	Cloudy	Cloudy	S. W.	N. E.	S. W.	0.59
17	56	62	58	30.05	30.12	30.13	Rain	Fair	Fair	N. E.	N. E.	N. E.	0.41
18	55	64	58	30.21	30.22	30.22	Fair	Cloudy	Fair	N. W.	N. E.	S. E.	
19	53	62	56	30.15	29.99	29.93	Rain	Fair	Rain	S. W.	E.	N. E.	
20	56	73	65	30.08	30 12	30.20	Fair	Fair	Fair	N. W.	E.	S. W.	0.85
21	62	76	65	30.20	30.12	30.11	Fair	Fair	Fair	S. W.	S. W.	S. W.	
22	62	78	70	30.03	30.02	29.98	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	0.02
23	70	82	72	29.90	29.92	29.93	Fair	Fair	Fair	S. W.	S. W.	S. W.	
24	66	79	60	29.97	29.97	29.98	Fair	Fair	Fair	S. W.	W.	N. W.	0.17
25	50	62	52	30.01	30.01	30.08	Fair	Fair	Fair	N. W.	N. W.	N. W.	
26	48	71	62	30.08	30.08	30.06	Fair	Fair	Fair	N. W.	N. W.	S. W.	
27	57	77	64	30.07	30.07	30.07	Fair	Fair	Fair	S. W.	S. W.	S. W.	
28	62	72	65	30.10	30.10	30.11	Fair	Fair	Fair	S. W.	S. W.	S. W.	
29	65	79	68	30.13	30.18	30.19	Cloudy	Fair	Fair	S. W.	N. W.	S. W.	
30	62	70	64	30.20	30.20	30.15	Fair	Fair	Fair	N. E.	N. E.	S. W.	
31	65	76	71	30.10	30.00	29.92	Cloudy	Cloudy	Cloudy	S. W.	S. W.	S. W.	

Depth of rain fallen 5.61 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M :

Pl. XI

Canaries and Nests.

Pendleton's Lithog.y Boston.

THE NATURALIST.

NOVEMBER, 1832.

THE MICROSCOPE.

NO. IV.

ACTIVE MOLECULES CONTINUED.

Mites, &c. in Seeds. Various species of mites, and other curious insects may be found in the siftings of seeds, particularly a very peculiar one, in those of the common poppy ; this insect is furnished with two fangs of a very formidable description, having joints like the claw of a lobster. With these fangs it seizes its prey and conveys it to its mouth. I would recommend every person possessing a microscope to provide himself with some of these siftings.

Beetles. So great is the variety of the beetle tribe, that it would be impossible to enumerate them in the limited extent of these articles. They come from a grub, or maggot, deposited in the earth by the female.

The Diamond Beetle, *Circulio regalis.* It is impossible to conceive anything more beautiful under the microscope than in this insect. It is found in the Brazils and other parts of South America, and is decorated with large, brilliant, gold-color patches, dispersed in rows over the wing covers, which are of a jet black: these patches owe their brilliancy to innumerable scales or feathers, and, through the microscope, exhibit the varying lustre of the most brilliant gems: these feathers are similar to those on the wings of the butterfly, &c.; a few may be placed on a piece of glass, and when examined with a high power, parallel lines will be observed, extremely fine, forming an excellent test of the goodness and power of a microscope.

The Circulio Argentatus. A male species of the diamond beetle found in England. It is about a quarter of an inch in length and, viewed with the microscope, exhibits a splendor of the diamond character, produced by a covering of scales of a beautiful gold-green color: it may be found in the fields and gardens, in the summer months, or on the leaves of trees, &c.

Caterpillars. The caterpillar is one state of the butterfly. If the silk worm be observed in every stage, from the caterpillar to the moth, it will give a correct notion of this class in general.

The body consists of twelve rings, and the changing its skin is effected by its withdrawing from the old one as from a sheath; and to accomplish which seems to be the work of time, but which they do successively three times before they arrive at their perfect state. The skins which they shed may be viewed by the microscope to much greater advantage than the real insect, and are well worth procuring; one, in particular, having four tufts of yellow hairs, and covered with smaller ones: these, when examined, appear like feathers.

Insects on the Bark and Leaves of the Ash. On the bark and leaves of the ash and other trees a small insect is found, inclosed in a dark spot, not larger than a pin's head; each spot serves as a covering for thirty or forty ova, which, on removing a fine silken covering, may be seen of a scarlet color; these turn to a beautiful little insect of the same color, but extremely minute, and it is pleasing to see them creep out of their cases.

The Flea. This well-known insect is covered all over with a shining armor, or scale, curiously jointed, and folding one over the other, with long spikes in regular order: its neck is finely arched: its head is very extraordinary, for, from the front part proceeds two legs, and between them its sucker or piercer, by which it penetrates the skin of animals, and draws out the blood. It has two large black eyes, and a pair of horns, or feelers; it has also four other legs, and when it takes its amazing leaps, it folds the short ones within the others, and, exerting its spring at the same time, carries itself to a great distance for so small a creature. These insects are male and female; they deposit their eggs on the hair of cats, dogs, &c., sticking them on with a kind of glutinous matter. When hatched, they are not perfect, but are small maggots, which feed on the juices of the body; from this state they change to the perfect flea. By keeping a few of them in a glass tube, you may procure their eggs. The best method of dissecting a flea is in water; and to examine the sting, cut off the head, and place it under the glass,—by gently pressing it, you force out the sting; this sting, or lancet, is lodged between the

fore legs, and after it has made an entrance, the blood flows freely from the adjacent parts.

THE LOUSE. The louse has so transparent a shell, that we are able to discover the circulation of the blood: the head has two large black eyes; the legs, six in number, with hooked claws, act as a thumb or finger; the body and legs are covered with hair. It lays its eggs in human or other hair; these are what are generally called nits, and are worth while examining: they are stuck on firmly to the hair with a glutinous matter. The young one comes forth from the nit a perfect animal. We cannot wonder at their increase, when one female will lay fifty eggs in a day, and these come to life in six days.

SPIDERS. Every one is acquainted with the general form of a spider without the assistance of a microscope. We shall give a description of the different parts of this insect which are only to be discovered by it. As the fly, the spider's natural prey, is extremely cautious and nimble, it is necessary that the latter should be able to look in all directions, and the number and disposition of the eyes are wonderfully adapted for this purpose; it has eight eyes, and as it can not move its head, they are placed round it so that it can see in all directions. The weapons that it uses to kill its prey are well worthy of attention. They consist of a pair of claws, or forceps, in the fore part of its head. It is hairy round the mouth, and it has two rows of teeth. Spiders frequently cast their skin, which may be found in cobwebs. The spider's web is formed by a gummy liquor proceeding from the tail, which adheres to any body that it presses against, hardens in the air, and becomes a thread of so fine a texture, that it is calculated that it would take ten thousand of them to make a single human hair. The eggs of the spider are curious objects, flat at one end and a circle round them: the young spider comes out perfectly formed. The egg, which the female guards with the greatest care, is deposited in the web. The number of eggs in one nest are several hundred. There are two or three kinds, particularly worthy of notice: a small white field spider, found among new hay; the leaping spider; another with two tufts of feathers in its fore paws, and spotted; and a small red spider, found on trees. The eyes, mouth, and legs, when examined with the microscope, will be found most beautiful and interesting objects.

THE COMMON FLY becomes an interesting object by dissecting it, and placing the different parts under the microscope: the body is covered with long hair; the head contains two large eyes, and is one of the most curious objects under the microscope that

can be conceived, for it is found to contain a number of lenses, or eyes, and, like the spider, it cannot move its head: the trunk consists of two parts, sheathed in the mouth. It deposits its eggs in any kind of flesh; these are generally called flyblows, but if examined, will be found perfect eggs: from the egg proceed minute worms, or maggots, which in a few days become flies.

The Snail. The eyes of the snail are placed upon its horns, in appearance like two black spots; the mouth resembles a hare's and the heart may be seen beating under the neck by dissecting it. It lays its eggs with great care in the earth and comes forth with the shell perfect. By confining it under a flower pot, you will most likely find some of its eggs in a few days, about the size of a pea, and of a beautiful, regular form.

The Ant. The ant is well worthy of notice: it is a creature of a very singular habit and structure; its head large, with pearled eyes; its mouth opens wide, which enables it to carry bodies much larger than itself; the head, body, and hind part, are held together with a very fine ligament; the tail is armed with a sting, and the eyes are covered with hair. The opening of an ant hill throws the whole community into confusion, some carrying pieces of sticks, and others their young in the aurelia state. Ant's eggs are about the size of a grain of sand, and produce maggots, which spin themselves coverings, and in a certain time become ants. The ant's affection for its young is so strong, that, when danger is near, it will run away with them, and sooner die than leave them. The following account of these insects is taken from Baker's Employment for the microscope: 'Every nest appears to have a straight hole leading to the centre; then another sloping off to the magazine, where the grain they collect is stored up; the corn, being under ground, would grow, did they not use the precaution to bite out the germ, or bud, before they lay it up,—this they constantly do, for, if examined, none will be found; it would likewise be liable to rot, but this they remedy in the following manner:—they gather small particles of dry earth, and place them in the sun, every one bringing a particle, and in this manner a vast number is accumulated round the hole: their corn, when it is properly dry, is laid up in this earth under ground. The author of this account found a nest of ants in a box of earth, standing out of a window, two stories high; some corn lay at the bottom of the house, which obliged them to come down for it to supply themselves with food; they regularly came down from the top of the house to the bottom, and never went up without something in their mouths: some even travelled to the farthest part of the garden, and brought a load from thence. By frequent observations, he

found that it took one four hours to carry a load from the latter place to the nest. Sometimes they would become weary before they reached home: in this case it was common to see a stronger ant coming to meet them, and carry home their load.' The following curious circumstance came under my own observation:— Having occasion to keep a quantity of ants in the earth for the food of a nightingale, they were put in a large earthern pan; in turning them out from the bag, a number of them had lost their lives; a day or two after, I observed a number of dead ants in one particular spot, about the size of a half crown, placed in regular order at the extreme edge of the pan; on looking more closely, I discovered a number of live ants coming up from the bottom with dead ones in their mouths, making all of them towards this particular spot, depositing their load, and returning again, till they were all brought up to the surface. All these facts show the wonderful instinct of these little creatures.

The Peach, or Ruby-tail Fly. The most beautiful description of flies, in England, is the peach fly, found in gardens, which settles generally on the peach tree; the head is of a very beautiful blue, and the body of crimson. This fly cannot be caught without considerable dexterity: upon dissection it will be found to have a very small sting.

The following Objects require the greatest care in placing them before the microscope.

The Blight on Trees. Nothing is more common, in the beginning of summer, than to see the leaves covered with a blight; examine it, and you will see minute insects of a most delicate form: some are black, others green.

Roses, Pinks, and other Flowers. Among roses, pinks, and other flowers, a small insect may be found almost constantly; it is a little, long, nimble insect, the body like a wasp's with yellow wings.

A little insect likewise is found in what is termed the cuckoo spittle, or froth; it has very curious eyes.

A small white oblong insect sticks to rose-tree leaves, which turns into a little yellow locust.

There is also a curious insect on sweet-briar leaves in April and May, the horns of which are very remarkable.

Clothes Moth. This insect, which we may often find in books, is covered with silver-colored scales, which reflect the light, making it appear like pearl; and the scales themselves are of the most delicate and beautiful description.

The Multipes, or Scolependa has a very long and slen-

der body: its mouth is armed with a pair of forceps. In hot countries, where it is of a large size, it is venomous. It has fifty-four joints, and every joint a leg from each side, with two at the hind part,—in all, one hundred and ten. When it moves, the legs follow regularly. There are several sorts of these curious insects; they are found under stones and wood that have been lying for some time.

STINGS OF INSECTS. The sharp and penetrating instruments in tails of bees, wasps, &c. are distinguished by the name of stings,—weapons given them by nature to defend themselves against their enemies, whereas the proboscis of flies, gnats, &c. is to procure them food. The sting ejects a poisonous liquor; the proboscis sucks the blood. As the stings of all are nearly alike, by describing one the rest will be understood.

The Sting of a Bee has a horny sheath, and is shaped like a dart, with a barb similar to a fishhook. The bee strikes so hard, that if disturbed it cannot withdraw its sting from its object, but when undisturbed, it closes the barb and draws it out. To view the sting of a bee, cut off the bottom part of the body and press it, and the sting will come out: it may be nipped off with a pair of scissors, and kept for observation; the bag containing the poison generally comes out with the sting.

MISCELLANEOUS. The pearly eyes of insects are amazing pieces of mechanism, whose structure, without the assistance of the microscope, would have remained unknown to us. Butterflies, bees, ants, and many others, have two immovable caps, containing a number of hemispheres, placed in lines with the utmost regularity, resembling lattice work; these are a collection of eyes, like so many polished mirrors, which reflect the object; for example, the image of a candle may be distinctly seen in each.

Mr. Gill has produced some beautiful objects, which he calls his microscopic kaleidoscope, in consequence of the ever-varying regularity that presents itself to the eye of the observer, during the configuration of the alkalies of soda, ammonia, and potash, and the boracic, tartaric, and muriatic acids.

The 'Technological and Microscopic Repository' published by Mr. Thos. Gill, treats largely on interesting objects for the microscope, particularly on the dissection of minute insects, by T. Carpenter, Esq. of Calthorpe Street; the following are some of the most interesting subjects from the above.

T. Carpenter Esq.'s Observations on the Natural History of the *Hermorbeus perla* or plant-louse lion:—'These singular and beautiful insects attach their eggs to the edges of leaves, suspending them by minute threads. They choose such leaves

as the aphis have laid their eggs upon, and thus keep them out of the reach of the young aphides, which otherwise would destroy them in the egg state. The young aphides, on issuing from the eggs, commence feeding upon the juices of the leaf, and under the microscope, present the appearance of a flock of sheep in a field ; while they are thus luxuriating, the plant-louse lions, also issuing from the egg, crawl up the slender props on which they were suspended, and like wolves commence devouring the aphides, plunging into their delicate bodies a pair of powerful fangs, and sucking the juices. The wings of these insects are beautiful microscopic objects.'

The underside of the leaves of vegetables displays the wonderful organization of their parts.

If a small portion of any leaf is placed between two slips of glass, by wetting the inside of each with a little water, and sliding the one slip over the other, backwards and forwards, the water produces a clearness, and detaches the outside covering from the other part.

To examine the stem of any flowers, or particularly the mucilaginous matter, which adheres to the stalk of a stock gilly flower place it, as above described, between two slips of glass with a small portion of water, and after washing away the turbid water, and putting some fresh, a most beautiful object is furnished in the spiral or helical sap vessels.

A small portion of straw, steeped in a solution of pearlash, and then washed in water and dried, on being placed between two pieces of glass, (which must be one over the other,) will be found to separate under the microscope, and display its structure, composed of long slender filaments with rings round them.

I am favored by T. Carpenter, Esq. with the following curious and accurate description of the eyes of insects, and of the dissection of the eye of the dragon fly, by that gentleman, under one of his most powerful microscopes:—

'In dissecting the eyes of a variety of land and water insects, I find their construction differs materially from the human eye, and that nearly the whole of the insect tribe, have compound or clusters of eyes, varying in numbers according to the species. I have found in some forty, in others a thousand, and so on in progression, until I have met with upwards of thirty thousand distinct eyes in some species. I shall endeavor to explain to you the result of my investigation, by confining myself to the dissection of the large dragon fly, whose eyes, speaking in round numbers, exceed twenty thousand. The cornea I found composed of several thin plates; each plate was studded with minute lenses

fitting into each other, these lenses appeared to be alternately concave and convex, resembling a combination of acromatic object glasses in a telescope. Under the cornea I discovered a fine membrane full of minute ramifications, which I presume to be blood vessels, and immediately under this membrane I found a corresponding number of tubes which fitted the lenses in the cornea. I then removed the tubes, and came to the retina, in which there was the same number of divisions as the above lenses, so that each lens had a tube attached to it, which conveyed the image of any object formed on the lens to the divisions in the retina, and was from thence conveyed by numerous optic nerves to the sense of seeing in the brain.

Eggs of Insects. The eggs of insects are remarkable for figure and color, and for the regularity and exactness in which they are placed. We sometimes find a sort cemented round a twig of the sloe tree, damson tree, *&c.*; the variety of them is innumerable. They are found likewise in the water in spring; and on water cresses and other water plants appear to the naked eye only as slime. The common fly will deposit her eggs on meat with the utmost regularity; which with the assistance of the microscope, will appear in their true form. The same may be observed with respect to nits on the human hair; and if fleas are kept for a few days in the object box, some will be found to have lain their eggs, which may be examined under the microscope.

Wings of Insects. There is such an infinite variety in the contexture and form of the wings of insects, and such beautiful ornaments upon them, that none but those who have observed them can have any conception of their form and color: as the dragon fly, which is very transparent, dividing as it appears in long squares. The wing of the female dragon fly is different, in being more opaque, and forming itself into curious angles and shapes. Some are covered with bristles, as all kinds of flesh flies; others with feathers, as butterflies and moths. Many have their wings folded under a case, as beetles, earwigs, *&c.*—most of them extremely beautiful when brought before the microscope; all these wings have ribs, and blood vessels branching out at different parts of them. Under the wings of insects is a small bladder or poise; with which they balance themselves in flying; this carefully taken off, is a very curious object.

ORNITHOLOGY.

NO. X.

Longevity of Birds. The term of life varies greatly in birds and does not seem to bear the same proportion to the time of acquiring their growth, as has been remarked with regard to quadrupeds. Most birds acquire their full dimensions in a few months, and are capable of propagation the first summer after they are hatched. In proportion to the size of their bodies, they possess more vitality, and live longer than either man or quadrupeds. It is no very easy task to ascertain the ages of birds; nevertheless, we have, on unquestionable authority, instances of great longevity in many of them—particularly geese, swans, ravens and eagles; among which, eagles have been known to attain the age of sixty, seventy, eighty or even a hundred years. The following scale has been given by Linnæus, Buffon, and other celebrated naturalists.

An eagle	will	live	100	years.
A raven	"	"	100	"
A goose	"	"	70	"
A partridge	"	"	25	"
A turtle dove		"	25	"
A peacock	"	"	25	"
A pigeon	from		10 to 20	"

Linnets, goldfinches, canary birds, and others, in a state of captivity, have been known to live many years. The longevity of birds has been imputed to the texture of their bones, whereas, on the contrary, the hardness and solidity of bones have been assigned as the general cause of death in other animals. Those of birds being lighter, and more porous in their conformation, present fewer obstacles to the vital powers. Hence, it has been assumed that the less solid the bones are, the more distant will be the period of dissolution.

Moulting of Birds. From the great longevity of birds, it has been inferred that they are subject to a few diseases only; their annual moulting is thought to be the only one to which they are universally liable. As quadrupeds cast their hair, so all birds every year obtain a new covering of feathers; this is what is termed moulting. During its continuance, they always appear sickly and disordered; the boldest lose their courage; none produce young, and many die under the visitation. No feeding can maintain their strength, or preserve their powers of reproduction. The nourishment which formerly went to the production of the young, is now consumed and absorbed in administering a supply

to the growing plumage. The manner in which nature performs this operation is slow in its progress. When birds have attained their full size, the pen part nearest the animal grows harder and thicker in its sides, but shrinks in its diameter; in consequence of the first of these processes, it draws gradually less nourishment from the body of the animal, and by its decrease in size, it becomes loose, till at length it falls off. In the meantime, the rudiments of an incipient quill are forming; the skin becomes in shape like a little bag, which is fed from the body by a small vein and artery, and which every day increases in size, till it is protruded. While one end vegetates into the beard or vane of the feather, that part attached to the skin is still soft, and receives a constant supply of nourishment, which is diffused through the body of the quill by the artery and vein. When, however, the quill has come to its full growth, and requires no further nourishment, the vein and artery become gradually less, till at last the small opening by which they are communicated with the quill is stopped, and the circulation ceases. The quill, after it is thus deprived of new supplies, continues for some months in the socket, till at last it shrinks, and makes room for another repetition of the same process of nature. The moulting season generally commences at the end of summer, and the birds continue to struggle under the malady for a considerable part of the winter; then the appetite of the animal is least craving, while its provision continues to be most scanty. It is not till the return of spring, when the feathers have attained their full growth, that the abundance of food and the mildness of the season restore it to its full vigor.

THE CANARY BIRD.

Fringilla canaria.

The subject of our vignette and description, is the jonquil cock and mealy hen of bird fanciers. The fancy bird has a tuft of feathers of a fine gamboge yellow, inclining from the middle to each side; the throat, breast, and under part the same; the neck, back, and wings, beautifully waved and mottled with different tints of pale, purplish-gray.

In length, this beautiful species is about five inches and a half; the bill a pale-flesh color, passing into reddish-white; eyes ches-

nut-brown; the whole plumage of a rich, deep-primrose color, inclining to yellow; edge of the quills sometimes yellowish-white; legs and feet, the same color as the bill. The female is distinguished from the male by the plumage being of a paler color; the yellow round the bill, eyes, and on the breast and edge of the wing, being also of a paler yellow; she is likewise rather larger and less slender in form towards the tail.

The oriental stock is said to have been imported into England from the Canary Isles about the fourteenth century; a circumstance not mentioned by Belon, and discredited by Syme, for these reasons. 'The wild birds found in the Canary Isles,' says he, 'bear less resemblance, in song and plumage to the domestic canary, than to the siskin of Germany, the venturon of Italy, or the serin of France. The plumage of these is a mixture of yellow, green, and a very little brown or gray; while the wild canary has a plumage of dingy, greenish-gray. One of these birds which I received from St. Michael's sung very much like the linnet.'

'If the nightingale is the chantress of the woods,' says Buffon, 'the canary is the musician of the chamber; the first owes all to nature, the second something to art. With less strength of organ, less compass of voice, and less variety of note, the canary has a better ear, greater facility of imitation, and a more retentive memory; and as the difference of genius, especially among the lower animals, depends in a great measure on the perfection of their senses, the canary, whose organ of hearing, is more susceptible of receiving and retaining foreign impressions, becomes more social, tame, and familiar: is capable of gratitude and even of attachment; its caresses are endearing, its little humors innocent, and its anger neither hurts nor offends. Its education is easy; we rear it with pleasure, because we are able to instruct it. It leaves the melody of its own natural note, to listen to the melody of our voices and instruments. It applauds, it accompanies us, and repays the pleasure it receives with interest, while the nightingale, more proud of its talent, seems desirous of preserving it in all its purity, at least it appears to attach very little value to ours, and it is with great difficulty it can be taught any of our airs. The canary can speak and whistle; the nightingale despises our words, as well as our airs, and never fails to return to its own wild-wood notes. Its pipe is a masterpiece of nature, which human art can neither alter nor improve; while that of the canary is a model of more pliant materials, which we can mould at pleasure; and therefore it contributes in a much greater degree to the comforts of society. It sings at all seasons, cheers us in the dullest weather,

and adds to our happiness, by amusing the young and delighting the recluse, charming that activeness of the cloister, and gladdening the soul of the innocent and captive.'

There are said to be upwards of forty varieties of the breeds of canaries, which can be easily distinguished; and the number is increasing annually. In London they have societies for promoting the breeds, and a premium is awarded to the competitor who comes nearest to the mould of perfection given out by the society the season prior to the competition.

There are two distinct species of canaries, the plain and variegated, or as they are technically called, the *gay spangles*, or *mealy;* and *jonks*, or *jonquils*, both of which are represented in plate xi. These two sorts are more esteemed by amateurs than any of the numerous varieties which have sprung from them; and although birds of different feathers have their admirers, some prefering beauty of plumage, others excellence of song, certainly that bird is most desirable when both are combined. The first property of these birds consists in the cap, which ought to be of fine, orange color, pervading every part of the body except the tail and wings, and possessing the utmost regularity, without any black feathers, as, by the smallest speck, it loses the property of a show bird, and is considered a broken-capped bird. The second property, consists in the feathers of the wing and tail being of a deep black up to the quill, as a single white feather in the wing or tail causes it to be termed a 'foul bird;' the requisite number of these feathers in each wing is eighteen, and in the tail twelve. It is, however, frequently observed that the best colored birds are 'foul' in one or two feathers, which reduces their value, although they may still be matched to breed with.

The dispositions of canaries are as various as their colors; some are gay, sportive, and delight in mirth and revelry, while others are sullen, intractable, and lazy. Some males are most assiduous in assisting the female to build her nest, and even to aid in the process of incubation, while others will destroy the eggs, or tear the young from the nest, and kill them in their rage. The gray ones will never build, and the person who superintends these must make a nest for them.

Mr. Syme informs us that he possessed a jonquil cock which used to nibble at its cage till he opened it, and then escaping from its prison house, it would fly to a mantel-piece, where it would place itself on a china vase, flutter as if in the act of washing, and continue to do so till water was brought. The same bird was so docile as to come, when called, to the hand, and hide trifling articles in the corner of its cage, stopping and looking around as if

for encouragement and applause. But one of his favorite amusements was to perch upon the branches of a tall myrtle in a window where the cage frequently hung; and he even became so bold, as to dart upon the ephemeral insects, which rose from a stream close by, and that seemed to afford him a delicious banquet. Poor Dickie was, however, doomed to suffer for this indulgence, and one morning was found dead in his cage, having been killed by a young pointer, a privileged vagrant like himself.

At a public exhibition of birds we are informed that one of these docile creatures acted the part of a deserter, and ran away, while two others pursued and caught him. A lighted match being given to one of these, he fired a small cannon, and the little deserter fell on his side, as if dead; another bird then appeared with a small wheelbarrow, for the purpose of carrying off the dead, but at its approach the little deserter started to his feet.

In rearing these birds all that is required is a small breeding cage; but where a room can be allotted to the purpose, it ought to have shrubs for them to roost and build, with plenty of water to drink and bathe in, that being indispensable for all birds. The light should be admitted into the room from the east; for the benefit of the morning sun, and the windows should have wire cloth, that they may enjoy the fresh air. The floor of the apartment should be strewed with sand or white gravel, and on that should be thrown, groundsel, chickweed, or scaled rapeseed; but when breeding, they should have nothing except hard, chopped eggs, dry bread, cake without salt, and once in two or three days, a few poppy seeds. Some bird fanciers, give their breeding birds plantain and lettuce seeds; but this should be done sparingly, and only for two days, lest it should weaken them.

About the last of April they ought to be furnished with flax, soft hay, wool, hair, moss, and other dry materials, for building their nest, which usually occupies three days. The period of incubation is thirteen days: but when the female has sat eight or nine days it is necessary to examine the eggs, holding them carefully by the ends toward the sun or a lighted candle, and to throw away the clear ones. Some bird fanciers substitute an ivory egg until the last is laid, when the real ones are replaced, that they may be all hatched at the same time.

When the young are to be reared by the sick, they must be taken from the mother on the eighth day, taking nest and all. Prior to this, the food should consist of a paste composed of boiled rapeseed, the yolk of an egg, and crumbs of cake unsalted, mixed with a little water; this must be given to them every two hours. This paste ought not to be too wet, and should be re-

newed daily, until the nestlings can feed themselves. The female has generally three broods in the year, but will hatch five times in the season, each time laying six eggs.

The process of moulting, which takes place five or six weeks after they are hatched, is frequently fatal to them. The best remedy yet known is to put a small piece of iron into the water they drink, keeping them warm during the six weeks or two months which generally elapse before they regain their strength. This malady to which they are all subject, is often fatal to the female after the sixth or seventh year; and even the male, though from superior attention may recover, and continue occasionally to sing, and survive his mate four or five years. He appears melancholy from this period, till he gradually droops, and falls a victim to this evil.

If it is proposed to rear gay birds, the male and female should be of the same deep color; if mottled birds are required, both parents should be mottled. When a gay bird and a fancy bird are matched, they are termed *mule* birds, because they are irregularly mottled in their plumage, and therefore of no value, although they are equally good singers. The spangled or French canary cock, with a mealy hen, often produce beautiful varieties.

The most common cause of disease in these birds proceeds from a superabundance of food, which brings on repletion. In this case the intestines descend to the extremities of the body, and appear through the skin, while the feathers on the part affected fall off, and the poor bird, after a few days, pines and dies. If the disease is not too far gone, putting them in separate cages, and confining them to the cooling diet of water and lettuce seed, may save the lives of many. They are also subject to epilepsy, asthma, ulcers in the throat, and to extinction of the voice. The cure for the first is doubtful; it is said that if a drop of blood fall from the bill, the bird will recover life and sense; but if touched prior to falling off itself, it will occasion death. If they recover from the first attack, they frequently live for many years without any alteration in their note. Another cure is to inflict a slight wound in the foot. Asthma is cured by plantain, and hard biscuit soaked in white wine; while ulcers, like repletion, must be cured by cooling food. For extinction of voice, the cure ought to be the hard yolk of eggs, chopped up with crumbs of bread, and for drink a little liquorice root, or a blade of saffron in water. In addition to these evils, the canary is infected by a small insect, if they are kept dirty. To avoid this, they should have plenty of water to bathe in, a new cage, covered with new cloth, and their seeds well sifted and washed. These attentions, if troub-

some, are nevertheless necessary to possess a thriving bird. When wild, all birds require water, and this is also necessary to the canary. If a vessel of snow be put into a cage, they will flutter against it with the utmost delight, even in the most severe winters. They are bred in immense numbers, both for commerce and amusement, in England, France, Tyrol, Germany, and other countries.

CABINET CYCLOPÆDIA.

SILK MANUFACTURE.

NO. XI.

Electric Properties of Silk. 'The discovery that silk is an electric, or a non-conductor of electricity, originated in one of those fortunate accidents to which science has been indebted for many of her most valuable discoveries. This fact it was which first led to the beautiful disclosure of the distinction between electrics and non-electrics.

'In 1729, while the knowledge of electrical phenomena was yet in its first infancy, Mr. Gray, after performing many interesting experiments, succeeded in conducting the electric fluid, excited by friction in a glass tube, through a perpendicular distance of many feet, by causing one end of a piece of iron wire or packthread to communicate with a glass tube, and the other end with an ivory ball. Pleased with his success, he became desirous of conducting the fluid horizontally; but this experiment failed at the time through the mode of his attempting it, which was by carrying his line over a packthread cord, suspended for the purpose across the room. Through this material, the electric stream escaped, and the ivory ball was, in consequence, no longer found to be excited.

'Mr. Gray having communicated to a friend the ill success which had attended this attempt, was advised to suspend the conducting line by *silk* instead of *packthread;* there being no other reason for this advice than the greater fineness of the former. Acting upon this suggestion, their first experiment was made in a large matted gallery; a line, the middle part of which was of silk and the two extremities of packthread, was fastened across

the gallery; the conducting line, with the ivory ball at the end was passed over the silken portion, and hung nine feet below this horizontal line of suspension. The conducting line was eighty feet and a half in length, one end being fastened by a loop to the electric tube; upon rubbing this, the experimenters had the gratification of finding that the ivory ball attracted and repelled light substances in the same manner as the tube itself would have done. They next contrived to return the line, so that the whole length amounted to 147 feet, and in this case likewise the experiment answered tolerably well; but suspecting that the attraction of the electric fluid would be stronger if the line were not doubled, they carried one straight forward through a distance of 124 feet. In this anticipation they were not deceived, the attraction under these circumstances being stronger than when the line was doubled. Proceeding thence to add more and still more to their conducting line, until at length the slender silk thread broke from the weight imposed, they sought to substitute for their fragile cord a small wire, first of iron and then of brass. The unsuccessful result, however, soon brought them to the conviction, that the refusal of the silk to conduct the electric fluid was not owing to its fineness, but proceeded from some inherent property possessed by the material. The metallic wires were smaller even than their silken thread had been, and yet they effectually carried off the electricity: thicker silken cords were therefore adopted, and, as before, the electric fluid was conveyed to a great horizontal distance, without suffering any diminution of its virtue.

'This knowledge of the non-conducting power of silk was quickly followed by the discovery of the same quality in many other substances, and thus accidentally was laid the foundation of many of the subsequent improvements in the science of electricity.

'No particular attention was paid to the electric qualities of silk, nor were any experiments made on it as an electric, until the year 1759. Mr. Symmer's notice was then attracted to the subject by the following whimsical circumstance, which led him to the performance of many curious experiments. The results of these he communicated to the Royal Society, by whom his paper was inserted in the fifty-first volume of their 'Transactions.'

'Mr. Symmer was in the habit of wearing at the same time two pairs of silk stockings; the under pair white, and the upper black. If these were pulled off together, no sign of electricity appeared; but if the black stockings were pulled off from the white, a snapping or crackling noise was heard; and when this happened in the dark, sparks were plainly perceived between

them. Thus incited, their philosophic wearer proceeded to make some further observations on the subject. He found, that by merely drawing his hand several times backwards and forwards over his leg while the stockings were upon it, he produced, in great perfection, the following appearances.

'On the stockings being taken off separately and held within a certain distance of each other, both appeared to be highly excited, the white stocking vitreously, the black one resinously.* While kept at a small distance from each other, they were so inflated that they exhibited the entire shape of his leg; and if brought somewhat nearer, would immediately rush together. The inflation gradually subsided as they thus approached, and their attraction of extraneous objects diminished as their mutual attraction increased, so that when they actually met, they became flat and adhered together like so many folds of silk. On being again separated, their electric powers did not seem to be at all impaired, and they continued for a considerable time to afford a repetition of these appearances. If the two white stockings were held in one hand, and the black ones in the other, they were thrown into a strange agitation, owing to the attraction exercised between those of different colors, and the repulsion between those of the same color. This conflicting of attractions and repulsions caused the stockings to rush to each other from greater distances than they would otherwise have done, and "afforded a very curious spectacle."

'If the stockings were allowed to meet, they adhered together with considerable force. They required at one time a weight of twelve ounces for their separation; and on another occasion, when they were more highly electrified, they sustained, in a direction parallel to their surface, as many as seventeen ounces, which was twenty times the weight of the stockings. If one were placed within the other, it required a weight equal to twenty ounces to separate them, although half of this sufficed for the purpose if the stockings were applied to each other externally.

'The black stockings being newly dyed, and the white ones first washed and then bleached by exposure to the vapor of sulphur, their mutual attraction was seen to be much increased. Under these circumstances, if one was placed within the other with their rough sides together, it required a force of three pounds and three ounces to separate them.

'With stockings of more substantial make, the cohesion was found to be still stronger. A white stocking of this description

* Vitreous and resinous electricity used to be termed positive and negative.

was placed within a black one of similar quality; first with the right side of one contiguous to the wrong side of the other, and afterwards with the two rough surfaces touching each other: in the first case they raised nearly nine pounds, and in the second, the still more surprising weight of fifteen pounds, without separating their surfaces. The tufts and ends of silk which are generally found on the inside of stockings considerably assisted towards the result of these experiments, which were not nearly so striking after these tufts were removed.

'In the course of his experiments, Mr. Symmer also discovered that black and white silk, when highly electrified, not only cohere to each other, but will also adhere to any broad, and to any polished surfaces, even although these bodies should not be themselves electrified. Having undesignedly thrown a stocking out of his hand, it struck against the side of the apartment, and adhered to the paper hangings. He repeated the experiment, and found that the stocking would continue its adhesion for nearly an hour. Placing a black and white stocking against the wall in this manner, he applied the two others to them, which had previously been highly electrified; and putting the white to the black and the black to the white, he carried them off from the wall, each of them hanging to that which had drawn it from its situation. When the stockings were applied to the smooth surface of a looking glass, they adhered even more tenaciously.

'Similar experiments, combining a greater variety of circumstances, were afterwards made with white and black ribins by Mr. Cigna of Turin, an account of which was published in the Memoirs of the Academy of that city for the year 1765.

'Having dried before the fire two white silk ribins, and extended them upon a smooth plane, he then several times drew over them the sharp edge of an ivory rule, and found that both ribins had by this friction acquired sufficient electricity to adhere to the plane, although they gave no indications of being in this state of excitement during their continuance upon it. It was not at all material to the success of the experiment, whether this plane was itself an electric or non-electric substance. When taken up separately, the ribins both appeared to be resinously electrified, and repelled each other: on dividing them, electric sparks were perceived between them, but on being again forced together or placed on the plane, no sparks were given off until they had been again excited by friction. When by means of the ivory rule they had thus acquired the resinous electricity, if, instead of being replaced on the smooth body whereon they had been rubbed, the ribins were applied to a rough conducting surface, they would on their

subsequent separation show contrary states of electricity, which would again disappear on their being brought together. If after having been made by friction to repel each other, they were forced together upon such a rough surface, they would in a few minutes be mutually attracted, the under one being vitreously and the upper ribin resinously electrified.

'If the two ribins were subjected to friction upon a rough surface, they uniformly acquired contrary states of electricity, the upper being resinously and the lower one vitreously affected, in whatever manner they might be taken off. The same change was instantaneously produced by the use of any pointed conductor. If, for instance, the two ribins having been made to repel each other, the point of a needle were drawn along the whole length of one, it would cause both instantly to rush together. The same means employed to effect a change of electricity in a ribin already electrified would communicate electricity to the other, which had not yet received excitement. An unelectrified ribin would become electrified if placed upon a rough surface and an electrified ribin were put upon it, or if the one were held parallel to the other and a pointed conductor were presented.

' Upon a smooth surface, Mr. Cigna placed a ribin which was not quite dry, and applied over it another that had been well dried before the fire, when, after applying to them the usual friction with the ivory rule, he found that, in whatever manner they were removed from the surface, the upper one was always resinously and the lower one vitreously electrified. Exactly the same results were produced if the ribins employed were black instead of white. If any kind of skin, or if a piece of smooth glass, were used in place of the ivory rule, the effect was exactly the same; but if a roll of sulphur were substituted, the ribins then uniformly acquired the vitreously electric state: when rubbed with paper, either gilt or not gilt, the effects were uncertain. If the ribins were placed between folds of paper on a plane surface and friction were then applied to them, both ribins acquired the resinous electricity. When one ribin was black, and the other white, the black generally acquired the resinous and the white the vitreous state, whatever might have been their relative position, or the manner of applying friction.

' Mr. Cigna likewise observed, that when the texture of the upper piece of silk was loose, yielding, or retiform, like that of a stocking, so that its elasticity caused it to move up and down with the corresponding movements of the rubber against the surface of the lower ribin; and if the rubber employed were of such

a nature as to communicate but little electricity to glass, the excitement did not depend upon the action of the rubber, but upon the body whereon it was placed. In such a case, the black silk was always resinously and the white vitreously affected. But if the ribin was of a close unyielding texture, and the nature of the rubber such as would communicate a high degree of electricity to glass, then the excitement of the upper piece depended altogether upon the rubber. Thus, if a white silk stocking were rubbed with gilt paper upon glass, it became resinously and the glass vitreously electrified; but if the piece of silk thus placed upon the plate of glass were of a firmer texture, it was always electrified vitreously and the glass resinously, when sulphur was employed as the rubber: and most generally the same effect followed the use of gilt paper.

'If an electrified ribin were brought near to an insulated plate of lead, it would be very feebly attracted. If then a finger were brought nigh to the lead, a spark might be observed to pass, and the ribin was powerfully attracted, but showed no further sign of electric excitement after coming in contact with the metal. On their separation, however, both substances appeared again electrified, and a spark passed between the plate and the finger.

'If several ribins of the same color were placed on each other upon a smooth conducting surface, and rubbed with a ruler, each, on being taken singly up, gave out sparks at its point of separation from the others; and on the removal of the last ribin, a spark would equally pass between it and the conductor. If all were drawn from the plate together, they cohered in one mass, which was resinously electrified on both sides. If after this they were laid together on a rough conductor, and then separated singly, beginning with that which had been at the bottom and next to the smooth conductor, sparks appeared as before, and all the ribins, with the exception of that at the top, were electrified vitreously. If friction were applied to them upon the rough conductor, and all were taken up without separation, the intermediate ribins acquired the electric state of either the highest or lowest, according as the separation was begun with either the one or the other. When two ribins were removed together from the rest, they clung to each other, and exhibited none of those indications of excitement which one, if taken alone, would have shown. When these two were separated, that which had been the outer one was found to have acquired electricity of an opposite nature to that of the remaining undivided ribins, but in a much weaker degree.

'Several ribins were placed upon a metallic plate, which was charged with electricity by means of a glass globe and a pointed

conductor, held to the side opposite to the ribins. The effect of this was, that all of these became electrified; but whether the state of their excitement was like to, or differing from, that of the plate, depended altogether on the manner of their removal, except that the ribin which was most remote always exhibited the opposite state of electricity to that of the metallic plate.

'Numerous other experiments, equally simple and easy of accomplishment, may be made on the electric properties of silk, which are, no doubt, familiar to such persons as have at all attended to the science of electricity. Silk, more remarkably than any other substance, exhibits a strong and permanent, attractive, and repulsive electric power. Its property of exciting electricity by friction is of extensive application, causing it to hold an important place among the substances employed to exhibit the wonders of this science: silk always forms part of the apparatus of electrifying machines.

'No attempt has been here made to bring forward anything new, or that has not been long well known upon the subject; but as many persons are prone to consider that experiments on scientific subjects must necessarily be invested with complexity, which places them beyond accomplishment by the uninitiated, the above trifling detail will serve to prove the fallacy of this opinion. The inartificial nature of the operations places them within the reach of all who are disposed to repeat them; and some natural phenomena may thus be brought within the observation of every one; adding one more instance to the crowd of examples wherewith we are surrounded, that the most simple substances of daily use, whose qualities of beauty or convenience are alone understood by the multitude, may be made to afford to the mind of the inquirer matter for philosophical amusement and instruction.'

CONCHOLOGY.

NO. IX.

Of the Methods of Polishing Shells. The art of polishing shells has but lately reached its present state of perfection; and as the admiration of sea shells has become so general, it may be expected we should give some instructions in the means of adding to their natural beauty.

Among the immense variety of shells with which we are acquainted, some are taken up out of the sea, or found on its shores in all their perfection and beauty; their colors being all disposed by nature upon the surface, and their natural polish superior to anything that art could give. Where nature is in herself thus perfect, it would be madness to attempt to add anything to her charms: but in others, where the beauties are latent, and covered with a coarse outer skin, art is to be called in; and the outer veil being taken off, all the internal beauties appear.

Among the shells which are found naturally polished are the porcelains, or cowries; the cassanders; the dolia or conchæ globosæ, or tuns; some buccina, the volutes and the cylinders, or olives, or, as they are generally though improperly called, the *rhombi;* excepting only two or three as the tiara, the plumb, and the butter-tub rhombus, where there is an unpromising film or surface, hiding a great share of beauty within. Though the generality of the shells of those genera are taken out of the sea in all their beauty, and in their utmost natural polish. There are several other genera, in which all or most of the species are taken up naturally rough and foul, and covered with an epidermis, or coarse outer skin, which is often rough and downy or hairy. The tellinæ, the muscles, the cochleæ, and many others are of this kind. The more nice collectors, as naturalists, insist upon having all their shells in their native and genuine appearance, as they are found when living at sea; but others who make collections, hate the disagreeable outsides, and will have all such polished. It would be very advisable, however, for both kinds of collectors to have the same shells in different specimens both rough and polished. The naturalist would by this means, besides knowing the outsides of the shell, be better acquainted with its internal characters than he otherwise would be; while those who wish to have them polished, might compare the beauties of the shell, in its wrought state, to its coarse appearance as nature gives it. How many elegancies in this part of the creation must be wholly lost to us, if it were not for the assistance of an art of this kind! Many shells in their native state, are like rough diamonds; and we can form no just idea of their beauties till they have been polished and wrought into form. The safest way of removing the epidermis or outer skin from shells, is by a simple process discovered by William Nichols, Esq. Lecturer on Natural Philosophy at London. The shell from which the epidermis, is to be removed, should be put into a vessel of water, with a quantity of quick lime, and boiled for some time. The skin of the common muscle requires only three hours boiling, while that of the *Mya margaritifera* or river

mya, requires from twelve to fourteen hours. When the shells have boiled the proper time, they should be washed over with diluted muriatic acid, when the skin may be easily removed by rubbing it off with the fingers.

Though the art of polishing shells is a very valuable one, yet it is very dangerous to the shells; for without the utmost care, the means used to polish and beautify a shell often wholly destroys it. When a shell is to be polished, the first thing to be examined, whether it have a naturally smooth surface, or to be covered with tubercles or prominences.

A shell which has a smooth surface, and a natural dull polish, need only be rubbed with the hand, or with a piece of chamois leather, with some tripoli, or fine rotten stone, and it will acquire a perfectly bright and fine polish. Emery is not to be used on this occasion, because it wears away too much of the shell. This operation requires the hand of an experienced person, who knows how superficial the work must be, and where he is to stop; for in many of these shells the lines are only on the surface, and the wearing away ever so little of the shells defaces them. A shell that is rough, foul, and crusty, or covered with a tartareous coat, must be left a whole day steeping in hot water: when it has imbibed a large quantity of this, it is to be rubbed with rough emery on a stick, or with the blade of a knife, in order to get off the coat. We have found different kinds of engraving instruments, of much service in removing the crust and extraneous matter from shells, particularly the parasitic species of shells which adhere to them, such as serpulæ and balanæ. If done with caution, it will be found by far the best mode; and, indeed, where there are spines, they cannot be removed by any other means, as by applying acids they are often completely destroyed. After this, it may be dipped in diluted aquafortis, spirit of salt, or any other acid; and after remaining a few moments in it, be again plunged into common water. This will add greatly to the speed of the work. After this it is to be well rubbed with linen cloths, impregnated with common soap; and when by these several means it is made perfectly clean, the polishing is to be finished with fine emery and a hair brush. If after this the shell when dry appears not to have so good a polish as was desired, it must be rubbed over with a solution of gumarabic; and this will add greatly to its gloss, without doing it the smallest injury. The gum water must not be too thick, and then it gives no sensible coat, only heightening the colors. The white of an egg answers this purpose also very well; but it is subject to turn yellow. If the shell has an epidermis, which will by no means admit to be polished, it is to be

dipped several times in diluted aquafortis, that this may be eaten off; and then the shell is to be polished in the usual way with pretty fine emery, or tripoli, on the hair of a fine brush. When it is only a pellicle that hides the colors, the shell must be steeped in hot water, and after that the skin is worked off by degrees with an old file. This is the case with several of the cylinders, which have not the natural polish of the rest.

When a shell is covered with a thick and fatty epidermis, as is the case with several of the muscles and tellinæ, in this case aquafortis will do no service, as it will not touch the skin: then a rough brush and coarse emery are to be used; and if this does not succeed, seal skin or as the workmen call it, *fish skin*, and pumicestone are to be employed.

When a shell has a thick crust, which will not give way to any of these means, the only way left is to plunge it several times into strong aquafortis, till the stubborn crust is wholly eroded. The limpets, *Auris marina*, the helmet shells, and several other species of this kind, must have this sort of management; but as the design is to show the hidden beauties under the crust, and not to destroy the natural beauty and polish of the inside of the shell, the aquafortis must be used in this manner. A long piece of wax must be provided, and one end of it made perfectly to cover the whole mouth of the shell; the other end will then serve as a handle, and the mouth being stopped by the wax, the liquor cannot get into the inside to spoil it; then there must be placed on a table, a vessel full of aquafortis and another full of common water.

The shell is to be plunged into the aquafortis, and after remaining a few moments in it, is to be taken out and plunged into the common water. The progress the aquafortis makes in eroding the surface is thus to be carefully observed every time it is taken out: the point of the shell, and many other tender parts, are to be covered with wax to prevent the aquafortis from eating them away; and if there be any worm holes, they also must be stopped up with wax, otherwise the aquafortis would soon eat through in those places. When the repeated dippings into the aquafortis show that the coat is sufficiently eaten away, then the shell is to be wrought carefully with fine emery and a brush; and when it is polished as high as can be by this means, it must be wiped clean, and rubbed over with gum water or the white of an egg. In this sort of work the operator must always have caution to wear gloves; otherwise the least touch of the aquafortis will burn the fingers, and turn them yellow; and often, if it be not regarded, will eat off the skin and the nails.

These are the methods which are to be used which require but a moderate quantity of the surface to be taken off; but there are others which require to have a larger quantity removed and to be taken off deeper; this is called entirely scaling a shell. This is done by means of a horizontal wheel of lead or tin impregnated with rough emery; and the shell is wrought down in thesame manner in which stones are wrought by the lapidary. Nothing is more difficult, however, than performing this work with nicety; very often shells are cut down too far by it, and wholly spoiled; and to avoid this, a coarse vein must be often left standing in some place, and taken down afterwards with a file, when the cutting it down at the wheel would have spoiled the adjacent parts.

After the shell is thus cut down to a proper degree, it is to be polished with fine emery, tripoli, or rotten stone, with a wooden wheel turned by the same machine as the leaden one, or by the common method of working with the hand with the same ingredients. When a shell is full of tubercles or protuberances which must be preserved, it is then impossible to use the wheel; and if the common way of dipping in aquafortis be attempted, the tubercles being harder than the rest of the shell, will be corroded before the rest is sufficiently scaled, and the shell will be spoiled. In this case, industry and patience are the only means of effecting a polish. A camels-hair pencil must be dipped in aquafortis; and with this the intermediate parts of the shell must be wetted, leaving the protuberances dry; this is to be often repeated; and after a few moments the shell is always to be plunged into water to stop the erosion of the acid, which would otherwise eat too deep, and destroy the beauty of the shell. When this has sufficiently taken off the foulness of the shell, it is to be polished with emery of the finest kind, or with tripoli, by means of a small stick; or the common polishing stick used by the goldsmith may be used.

This is a very tedious and troublesome thing, especially, when the echinated oysters and murices and some other such shells, are to be wrought; and what is worst of all, when all this labor has been employed, the business is not well done; for there still remain several places which could not be reached by any instrument, so that the shell must, necessarily, be rubbed over with gum water or the white of an egg afterwards, in order to bring out the colors and give a gloss; in some, it is even necessary to give a coat of varnish.

These are the means used by artists to brighten the colors and add to the beauty of shells; and the changes produced by polishing in this manner are so great, that the shell can scarcely be

known afterwards to be the same as it was; and hence we hear of new shells in the cabinets of collectors, which have no real existence as separate species, but are those well known, disguised by polishing. To caution the reader against errors of this kind, it may be proper to add the most remarkable species thus usually altered.

The oynx shell or volute, called the *purple or violet tip*, which in its natural state is of a simple pale brown, when it is wrought slightly, or polished with just the surface taken off, is a fine bright yellow; and when it is eaten away deeper, it appears of a fine milk-white, with the lower part bluish; it is in this state that it is called the *onyx shell;* and it is preserved in many cabinets in its rough state, and in its yellow appearance, as a different species of shell.

The *violet shell*, so common among the curious, is a species of porcelain, or common cowry, which does not appear in that elegance till it has been polished; and the common sea ear shows itself in two or three different forms as it is more or less deeply wrought. In its rough state it is dusky and coarse, of a pale brown, on the outside, and pearly within; when it is eaten down a little way below the surface, it shows variegations of black and green; and when still farther eroded, it appears of a fine pearly hue within and without.

The *nautilus*, when it is polished down, appears all over of a fine pearly color; but when it is eaten away only to a small depth, it appears of a fine yellowish color with dusky veins. The burgau, when entirely cleared of its coat, is of the most beautiful pearl color; but when slightly eroded, it appears of a variegated mixture of green and red; whence it has been called *parroquet shell.* The common helmet shell, when wrought, is of the color of the finest agate; and the muscles, in general, though very plain shells in their common appearance, become very beautiful when polished, and show large veins of the most elegant colors. The Persian shell, in its natural state, is all over white, and covered with tubercles; but when it has been ground down on a wheel, and polished, it appears of a gray color, with spots and veins of a very bright and highly polished white.

The limpets, in general, become very different, when polished, most of them showing very elegant colors; among these the tortoise-shell limpet is the principal; it does not appear at all of that color or transparence till it has been wrought.

That elegant species of shell called the *jonquil chama*, which has deceived so many judges of these things into an opinion of its being a new species is only a white chama with a reticulated

surface; but when this is polished, it loses at once its reticular work, and its color, and becomes perfectly smooth, and of a fine bright yellow. The violet-colored chama of New England, when worked down and polished, is of a fine milk-white, with a great number of blue veins, disposed like the variegations in agates.

The *asses-ear shell* or *Haliotis asinina* of Linnæus, when polished after working it down with the file, becomes extremely glossy and obtains a fine rose-color all about the mouth. These are some of the most frequent among an endless variety of changes wrought on shells by polishing; and we find there are many of the very greatest beauties of this part of the creation, which must have been lost had it not been for this method of searching deep into the substance of the shell for them.

The Dutch are very fond of shells, and are very nice in their manner of working them: they are under no restraint, however, in their works; but use the most violent methods, so as often to destroy all the beauty of the shell. They file them down on all sides, and often take them to the wheel, when it must destroy the very characters of the species. Nor do they stop here; but determined to have beauty at any rate, they are for improving from nature, and frequently add some lines and colors with a pencil, afterwards covering them with a fine coat of varnish, so that they seem the natural lineations of the shell. The Dutch cabinets are by these means made very beautiful, but they are by no means to be regarded as instructors in natural history. There are some artificers who have a way of covering shells all over with a different tinge from that which nature gives them; and the curious are often enticed by these tricks to purchase them for new species.

There is another kind of work bestowed on certain species of shells, particularly the nautilus; namely, the engraving on it lines and circles, and figures of stars, and other things. This is too obvious a work of art to suffer any one to suppose it natural. Buonani has figured several of these wrought shells at the end of his work; but this was applying his labor to very little purpose; the shells are spoiled as objects of natural history by it. They are principally wrought in the East Indies.

Shells are subject to several imperfections; some of which are natural and others accidental. The natural defects are those of age, or sickness in the fish. The greatest mischief happens to shells by the fish dying in them. The curious in these things pretend to be always able to distinguish a shell taken up with the fish alive from one found on the shores; they call the first a *liv-*

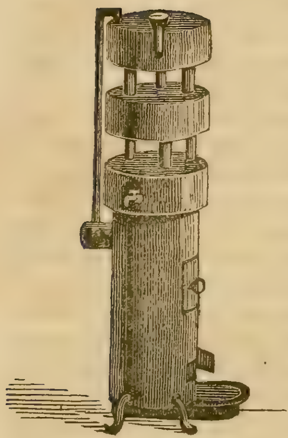
ing, and the second a *dead* shell; and say the colors are always much more fainter in the dead shells. When the shells have lain long dead on the shores, they are subject to many injuries, of which the being eaten by the sea worms is not the least; age renders the finest shells livid or dead in their colors.

Besides the imperfections arising from age and sickness in the fish, shells are subject to other deformities, such as morbid cavities, or protuberances, in parts where there should be none. When the shell is valuable, these faults may be hid, and much added to the beauty of the specimen, without at all injuring it as an object of natural history, which should always be the great end of collecting these things. The cavitiês may be filled up with mastic, dissolved in spirit of wine, or with isinglass: these substances must be either colored to the tinge of the shell, or else a pencil dipped in water colors must finish them up to the resemblance of the rest: and then the whole shell being rubbed over with gum water, or with the white of an egg: scarce any eye can perceive the artifice; the same substances may also be used to repair the battered edge of a shell, provided the pieces chipped off be not too large. And when the excresences of a shell are faulty, they are to be taken down with a fine file. If the lip of a shell be so battered that it will not admit of repairing by any cement, the whole must be filed down or ground on the wheel till it becomes even.

FESSENDEN'S STOVE.

The principles of this invention consist in forming an *easily portable apparatus*, which furnishes convenient modes of arresting and detaining much of that heat produced by fire for warming apartments, which in common stoves is suffered to escape through the smoke pipe and chimney. This is effected by exposing as large surfaces of water, inclosed in proper metallic vessels, as is conveniently practicable to the action of the heat of the fire-place, distributing the caloric, thus detained, within the apartment to be warmed, and condensing and bringing to the boiler, the steam thus arising, without the apparatus of valves, syphons, and so forth, heretofore thought indispensable in heating by steam.

The apparatus which constitutes my Steam and Hot-water Stove consists of a hollow cylinder, standing perpendicularly on



four legs. Within this cylinder are a grate, an ash pit, and a fire-place, with proper doors to admit fuel, take away ashes, and the like. Directly over the fire-place, and also within the cylinder, is a boiler; and over the boiler two or more flat cylindrical vessels, as represented in the figure, fitted with tubes to receive steam from the boiler, and yield heat to the air of the room. The tubes forming the channels of communication between the boiler and the receivers terminate within the latter, two or three inches above their bottoms; by which means water is retained in the lower parts of the receivers, while their upper parts are heated by steam. The extra steam not condensed in the receivers, is carried off by a small tube leading into the smoke pipe.

Although I have adopted, for the most part, in my Patent Stove, apparatus, similar in shape and component parts to that figured and described above, yet, its form and proportions may be varied indefinitely. And as the Patent Act declares that 'changing the form and proportions of any machine in any degree shall not be deemed a discovery,' I shall hold the unlicensed adoption of the *principles* of my stove, under any possible form or modification, to be a violation of my patent right.

T. G. Fessenden.

[Three desirable objects seem to be attained by the introduction of this stove, which are not realized by those in general use, namely, *economy, health,* and *convenience.* The expense of fuel is but about half as much as that of common stoves. The room in which it is used is entirely free from the dull, dry, and unhealthy atmosphere, which always accompanies the use of cast iron stoves. The room may be left at any time, after sitting for hours, without the least apprehension of taking cold; and on returning none of that pressure of the head is felt, as is often the case on entering a room heated by other stoves; but on the contrary there is a softness of atmosphere, calculated rather to promote cheerfulness, and inspire liveliness of spirits. Ed.]

ON FIRE.

The ancients had very inaccurate ideas of this element: they viewed it with a degree of reverential awe, and attributed to it the principle of life and animation. In some of the nations of antiquity it was reverenced as the supreme Deity; and was worshipped by the Egyptians and the Greeks under the name of Vulcan. The fire-worshippers near the Persian gulf make it the object of their adoration at the present day; and it is to the power of kindling and controlling fire that man owes his first and last superiority. Fire protects the savage from the lion, and gives motion to the steam engine. Nothing in nature exceeds the violent effects of fire; and the extreme rapidity with which ignited particles are put in motion is altogether astonishing. But how few people observe these effects, or think them worthy of their attention! Yet every day, in the midst of our domestic affairs, we experience the beneficial influence of fire; but perhaps on this very account we are less attentive. Were it not for the fire which cheers us in winter, a great portion of our time must be passed in dreary darkness; without artificial light all our occupations and our amusements must cease with the departing sun; we should be obliged to remain at rest, or to wander with uncertainty and danger in the midnight gloom. Think upon the hardness of our fate had we been condemned to pass the long evenings of winter without the enjoyments of society, and those superior sources of pleasure and instruction derived from reading and writing. How many of the productions of the earth would be useless to us were they not softened and prepared by means of fire? If fire was not had recourse to by artists, how many necessities would be unprovided for, and of what benefits should we not be deprived! Without this element we should not be able to give to our garments the brilliancy of the scarlet, nor the splendor of the purple; our metals, incapable of being melted, would remain useless in the depths of the earth; glass could not be formed from the sand: the beautiful utensils now in common use could not have been fashioned from the yielding clay; nor could our stately edifices rear their tops among the clouds, and bid defiance to the elements. Without fire, in vain would nature teem with riches: all her treasures would be useless, and her charms of no avail. But we have no necessity to traverse nature to prove the blessing of fire; let us return from our flight, and contemplate our own apartment. Here the fire diffuses a genial warmth over the whole room, and the air is rendered mild. Without the stimulating influence of

fire, during the strong frosts, we should become inactive, and subject to many unpleasant sensations; the aged and the weak would perish; and what would become of the little infant, if the chilly blasts were not tempered to its delicate limbs?

Fire dilates such bodies as are exposed to its influence. A piece of iron made to fit a hole in a plate of metal, so that it easily passes through when cold, being heated, cannot be made to enter; but upon being again cooled, readily passes into the hole as at first. This dilation caused by the heat, is still more perceptible in fluid bodies; as spirits, water, and more particularly air; and upon this principle our thermometers are constructed. If we observe the effects of fire upon compact and inanimate substances, we shall find that they soon begin to melt, and change in appearance, part becoming fluid, or remaining solid, but of a different nature. Heat communicates fluidity to ice, oil, and all fat substances, and most of the metals. Some solid bodies undergo other changes; sand, flint, slate, quartz, and spar, become vitrified in the fire; clay is converted into stone; marble, calcerous stones, and chalk are changed into lime. The diversity of these effects does not proceed from the fire, but from the different properties of the bodies upon which it acts. It may produce three kinds of effects upon the same body; it may melt, vitrify, and reduce it to lime provided that it possesses the three necessary properties, of being metallic, vitrifiable, and calcerous. Thus fire of itself produces nothing new; it only developes in bodies those principles, which, before its action, were not perceptible. Upon fluids, fire produces two effects, it makes them boil, and converts them into vapor. These vapors are formed of the most subtile particles of the fluid separated by the fire; and they ascend in the air because they are specifically lighter than that fluid. In living creatures fire produces the sensation of heat in every part of the body; without this element man could not preserve life; a certain degree of heat is necessary to give vitality and motion to the blood; for which purpose we are constantly inhaling fresh air, which always contains the matter of heat, and imparts it to the blood in the lungs, while this organ of respiration expels the air that has lost its vivifying properties.

METEOROLOGICAL JOURNAL,

KEPT AT BOSTON, FOR SEPTEMBER, 1832.

[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Morn.*	*Noon.*	*Even.*	*Inches.*
1	62	66	54	30.02	30.04	30.10	Cloudy	Fair	Fair	N. E.	N. E.	N. E.	
2	54	67	58	30.13	30.15	30.12	Fair	Fair	Fair	N.	E.	S. W.	
3	54	72	62	30.12	30.12	30.12	Fair	Fair	Fair	N. W.	S. E.	S. W.	
4	60	62	63	30.10	30.05	29.88	Rain	Rain	Cloudy	S. W.	S. E.	S. W.	0.36
5	68	72	56	29.75	29.84	29.89	Fair	Fair	Fair	S. W	N. W.	N. W.	
6	50	63	53	29.90	29.95	29.96	Fair	Fair	Fair	N. W.	N. W.	N. W.	
7	56	72	63	29.98	29.96	29.90	Fair	Fair	Fair	N. W.	S. W.	S. W.	
8	57	70	62	30.02	30.04	30.03	Fair	Fair	Fair	S. W.	S. W.	S. W.	
9	62	68	58	30.08	30.12	30.22	Fair	Fair	Fair	S. W.	N. W.	N. W.	
10	48	64	54	30.31	30.30	30.30	Fair	Fair	Fair	N. W.	W.	S. W.	
11	56	73	67	30.22	30.14	29.98	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
12	63	70	50	29.85	29.91	30.08	Cloudy	Fair	Fair	N. W.	N. W.	N. W.	0.38
13	46	60	48	30.12	30.15	30.22	Fair	Fair	Fair	N. W.	N. W.	N. W.	
14	46	66	52	30.25	30.22	30.20	Fair	Fair	Fair	N. W.	W.	N. W.	
15	54	72	62	30.20	30.15	30.10	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
16	60	75	62	30.05	30.08	30.12	Fair	Fair	Fair	S. W.	N. W.	N. W.	0.04
17	56	66	56	30.05	30.20	30.30	Fair	Fair	Fair	N. W.	E.	N. W.	
18	52	75	64	30.15	30.30	30.30	Fair	Fair	Fair	N. W.	N. W.	S. W.	
19	62	82	70	30.35	30.17	30.16	Fair	Fair	Fair	N. W.	N. W.	N W.	
20	64	76	68	30.20	30.09	30.08	Cloudy	Fair	Fair	N. W.	E.	S. W.	
21	60	62	63	30.10	29.90	29.78	Cloudy	Rain	Cloudy	N. W.	S. E.	S. E.	
22	65	72	56	29.85	29.85	29.84	Cloudy	Rain	Fair	S. W.	S. W.	N. W.	0.27
23	52	63	49	29.85	30.10	30.11	Fair	Fair	Fair	N. W.	N. W.	N. W.	
24	46	65	56	30.13	30.10	30.03	Fair	Cloudy	Rain	N. W.	S. W.	S. W.	
25	56	60	52	29.85	29.74	29.92	Cloudy	Cloudy	Fair	S. W.	N. W.	N. W.	0.42
26	46	64	52	30.07	30.10	30.10	Fair	Fair	Fair	N. W.	N. W.	S. W.	
27	50	65	59	30.10	30.10	30.11	Fair	Fair	Fair	N. W.	E.	S. W.	
28	60	73	56	30.11	30.11	30.12	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
29	57	59	58	30.10	30.00	29.86	Cloudy	Rain	Rain	S. W.	N. E.	N. E.	0.27
30	58	62	56	29.83	29.82	29.90	Rain	Rain	Cloudy	N. E.	N. E.	N. E.	0.07

Depth of rain fallen 1.81 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.

PL. XII

From a Sketch by C. T. Jackson

Pendleton's Lithog.y Boston

VIEW OF THE DETATCHED MASSES OF TRAP ROCK AT THE SOUTH-WEST EXTREMITY OF PARTRIDGE ISLAND.

THE NATURALIST.

DECEMBER, 1832.

THE MICROSCOPE.

NO. V.

THE CIRCULATION OF THE BLOOD.

In order to view the blood circulating through its vessels, we must procure animals, the skins of which are transparent, and no object is better calculated for this purpose than the small tadpole. The circulation of the blood in this little animal is a most magnificent spectacle. In order to view it to advantage with the microscope, place a piece of window glass about two inches by one upon the stage; upon this the animal is to be placed without any further preparation.* The tail will now lie flat, and, being very transparent, the innumerable channels contained in it will be perfectly visible, within which the blood, consisting of globules suspended in serum, will be perceived coursing with extreme rapidity in all possible directions.

Along one side of the longitudinal tapering substance in the centre of the tail, a main conduit proceeds to the extremity thereof, returning towards the body, at a very small distance from the salient part, and in a parallel direction; from this, branches pro-

* When the animal is first placed upon the glass, it usually wriggles about, but soon becomes quiet, and ramains so for some time. Should it repeat its motion, there will always be sufficient intervals of quiet for readjustment and examination which makes this mode of submitting to the microscope preferable to any attempt to confine it. A small quantity of the water should be placed upon the glass; the power, No. 2, is the most suitable.

ceed latterally, which subdivide themselves to infinity. The subdivisions of each of the branches are joined at their extremities, thereby forming a perfect connexion between the whole. The blood proceeds from the main conduit by each alternate branch, and after passing through the various subdivisions of one branch, enters those of the next, on each side of it, by which it returns into the main conduit, and this process is repeated, until the mind is bewildered in its attempts to trace its course in all its minute ramifications.

In this description the usual term of arteries and veins have been avoided, as, in this animal, the distinction seems to be lost in consequence of the blood appearing to issue from, and return into the main conduit both in its salient and returning part, although it is probable that the returning main conduit is really a vein, receiving the returning branches, or veins, which must, in that case, pass either above or below, and not into the salient part of the main conduit or artery. As the substance in which these main conduits are inserted is much more opaque than the rest of the tail, the phenomenon cannot be so well observed, and it is, in consequence, difficult to arrive at a safe conclusion; however, enough is to be perceived to excite the wonder and admiration of every beholder.

The Blood. Upon submitting the blood to the microscope, it is immediately perceived to consist of globules suspended in a white transparent serum. A remarkable fact will strike every observer, viz. there will be seen a continual motion of the globules, as if they were acted upon by some unknown agency. This motion appears completely vibratory, like a balance which has received an impulse; it is difficult to account for this phenomenon, but the following hypothesis is hazarded. This seeming tendency to motion in the globules, may be a material assistance to the impulse given by the heart, whose mere mechanical force, however great, appears hardly sufficient to propel the globules through such inconceivably minute ramifications, through which we know it does pass, previous to reaching the organ of circulation by the larger veins.

Place a small drop of water upon a slip of glass, into which introduce a drop of warm blood, by which means the globules will be separated, and become distinctly visible; use that power which will most enlarge them without taking away from their distinctness.

Pulsation of the Heart. This wonderful phenomenon may be seen distinctly in several small insects; in a bee it is observable near the neck, but the best insect to view it in, owing to its transparency, is the water flea.

Feathers of Birds. The feathers of birds afford a variety of beauty, and differ greatly from one another, not only in their form, but in the structure of each particular part. The feathers of tropical birds have the most beautiful plumage. The handsome and delicate colors of the humming bird and the tail of the peacock are well worth observation.

Scales of Fishes. The scales or outward coverings of fishes, are formed with surprising beauty and variety of shape, and texture—as the perch, sole, barbel, cod, etc. The scales of eels in particular are very small;—the way of preparing them is to take them off with the forceps, and put them between a sheet of paper to keep them flat till dry. The arrangement of the scales of fishes bears a resemblance to that of the feathers of birds. The serpent and lizard have likewise scales. The scales of the sole and dace are well worth preserving for the microscope.

Hairs of Animals. Hairs of animals are very different in their appearance before the microscope, and will furnish a great variety of pleasing observations; they are composed of small tubes or pipes. There is also in the hair of many animals spiral lines; a mouse's hair is of this description; the human hair is also a good specimen.

Farina of Flowers. The farina or scaly powder, found on the top of every flower, deserves the strictest examination. This powder, whose color is different in flowers of different kinds, was formerly supposed to be an unnecessary part of the plant; but the microscope has also made surprising discoveries here, by showing that they are minute, uniform bodies, constantly of the same figure. This powder is produced and preserved in vessels wonderfully contrived to open and discharge it when it becomes mature; there are, likewise, seed vessels in the centre, ready to receive them; and on the powder depends the fertility of the seed, for if the farina vessels were cut away, the seed would become barren. In the farina of the melon it appears as opaque black balls; in the sunflower, surrounded with sharp points; in the tulip, like the seeds of cucumbers. Gather the farina on a fine sun-shining day, when the dew is off, be careful not to squeeze or press it. Gently brush it off with a soft hair pencil upon a piece of clean paper or slides prepared with a little gumwater.

Down of Plants, Nature has supplied the seeds of the thistles and many other plants with a down, which serves, instead of wings, to convey them from one place to another. The figures of such down are very different when examined by the glass,

some plain and smooth, others rough, and some with little hooks or clasps, to catch hold of any thing.

Seeds. Most kinds of seeds must be prepared by steeping them in warm water to discover the minute plants they contain. The seeds of strawberries rise out of the pulp, and appear like strawberries. When viewed, seeds of the poppy, lettuce, thyme, parsley, and a thousand others, afford delightful entertainment. The fungus, or puff ball, when crushed, seems to the naked eye like a smoke, or vapor. When examined with the highest power, it is found to be composed of little globules of an orange color.

Leaves. The leaves of plants are full of veins or ramifications, which convey the juices. The leaves of the yew are full of holes, like the honeycomb. The sage leaf appears full of knots, or little beads.

Cuttings of Wood. The air vessels and pores of wood appear wonderful in their figure and variety when shaved off as thin as possible. Fir and cork are the best for examination; but all the kinds of wood may be rendered fit for the purpose. It is advisable to have several slides filled with the different kinds of wood, both American and foreign. In a piece of cork, no larger than the eighteenth part of an inch, sixty cells were numbered in a row; whence it follows, that one thousand and eighty are in the length of an inch; one million, one hundred and sixty-six thousand, and four hundred, in a square inch. From the pith of trees cut so that they become transparent, the vessels may be seen. The pith of elder is a beautiful object for this purpose.

Mosses. Mosses of all kinds are agreeable objects, and appear by the microscope to be as perfect in their parts as the largest trees; those which grow on the rocks and coast of the sea exhibit amazing beauty.

Sand. There are many sorts cf sand on the sea shore, or within land; their varieties are very agreeable to examine; some have angles and rough coats; others, the most beautiful polish, and as transparent as the diamond.

Sponge. Sponge is a plant and appears to be composed of minute tubes, or vessels, which by their capillary attraction, is the cause of its absorbing so much water. The fibres should be examined separately.

Mouldiness. All kinds of mouldiness on decayed fruit, bread, etc. the microscope discovers to be exceedingly minute plants, bearing leaves, and in every respect, developing the same beauty and regularity as the leaves of trees.

The Method of Preparing Salts for Viewing their Crystallizations. After dissolving the salt in water sufficient

to saturate it, and being perfectly dissolved, let it rest for a few hours; the solution being thus prepared, take up a single drop and place it on a slip of glass; spread it gently over the glass, as level as possible; hold it near a fire or candle, to give it a gentle heat. When the edges begin to look white having your microscope ready, place the glass, and you will see the formation of the crystals; when the action once begins, the eye should not be taken off, for the figures, in forming, alter every instant till perfect. If you provide yourself with several small bottles, a collection of the solution of the different salts may always be in readiness for the microscope, and by a variety of combinations, you may produce several thousand subjects for examination—a sight no one can behold without delight. As soon as they become formed, they are either cubes, rhomboids, pyramids, or certain regular figures, showing always the same sides or angles, in different substances. The following are the best for this purpose. Nitre, rock salt, Glauber's salt, sal ammoniac, hartshorn, green vitriol, white vitriol, and salt of amber.

The following description of the formation of the crystals of alum is taken from Mr. Baker's work on the microscope. 'The configurations of this salt abound with beauty and variety; place a drop of this solution on the glass, and, gently heated, it exhibits at the beginning, a dark cloud, which appears in motion near the edge, and runs swiftly through to the right and left, till they join; these, when examined, appear to be salts shot into slender lines, which cross one another at right angles.

'Crystals of Silver. These form a beautiful opaque object. In a drop of nitrate of silver, put a fine piece of copper wire, or the point of a pin; place it directly under the microscope, and the crystals will extend till the fluid is evaporated; this object may be permanently preserved: take a piece of Bristol card paper of the required thickness and of the same size as the glass to which it is to be fixed; punch an aperture in the centre of the card, then, with gum or paint, fix it upon the glass, place a drop of the solution of nitrate of silver within the aperture into which drop a small particle of copper; when the crystals have formed and the evaporation subsided, cover the aperture with glass or talc.

'By dissolving any mineral in muriatic or nitric acid, and placing it under the microscope, you will perceive beautiful crystals formed.

'Common Salt. Place a single drop of water in a glass, and put a few particles of common salt in it; give it a gentle heat till the water is evaporated, and you will have beautiful crystals in the form of cubes. Epsom salt will be formed into six-sided

prisms, alum into octagons, crystals of nitre, saltpetre, and green vitriol into the same form. To obtain crystals of camphor, place a drop of spirits of wine on a glass, hold it over a candle; when evaporated, place it on the microscope, and they will be seen.'

To find the Magnifying Power of the Microscope. Place a micrometer upon the stage, (one of the two-hundredths of an inch will be the most useful for this microscope,) and adjust it to the focus of the power in use. In order to ascertain how many times the squares are magnified, no more will be necessary than to ascertain the size of the magnified image of one of them, and the best method to do which is the following:—on several pieces of card rule a few squares which bear a known proportion to an inch, beginning at about three-quarters of an inch; and decreasing very gradually, until you arrive at a tenth of an inch. The use of these pieces of card is exemplified by the following example.

Suppose the lowest power to be in use, with the above micrometer upon the stage, adjusted to the true focus, compare the squares upon several of the pieces of card, and select that which contains squares of the same size as the magnified image; and having previously noted upon each piece of card the proportion each square bears to an inch, you immediately know the size of the magnified image, which in this instance is indicated by the card to be a tenth of an inch; and as the two-hundredth of an inch is contained twenty times in the tenth of an inch, so many times is the length of an object magnified; and as the breadth is magnified in the same proportion, the square of twenty must be taken, which is four hundred, the true magnifying power.

The following are the different magnifying powers of the microscope.

	Single.	With the Compound Body.
No. 1, the lowest power magnifies .	100	625 times.
No. 2, second power ditto . .	144	900
No. 1 & 2 combined together, 3d power,	400	2500
No. 3, fourth power ditto . .	4225	26,000

Other powers may be added to this microscope as described in the table.

N. B. The *height* of an object being magnified in the same proportion as the length and breadth, the cubes of the magnified diameters might be introduced in the above scale, although it must be admitted, that the height is, in a great measure, lost to the eye, in consequence of its being perpendicular to the object; therefore, in estimating the magnifying power, the cube is usually rejected.

To find the Magnitude of a Minute Object. The most correct and readiest way on all occasions to find the magnitude of an object, is to take a piece of glass, divided into any number of parts, or lines, of 100 or 200 to the inch; it may be placed on the stage, and a drop of water, or any other object put upon it. Find what proportion the object bears to the space within the two lines, and if it take the whole space, it is one or two-hundredth part of an inch, according to the scale.

The Works of Art and Nature compared together. Upon examining the edge of a very sharp razor, it will appear as broad as the back of a knife, and full of notches. The point of a small needle, though extremely fine to the naked eye, will appear through the microscope full of holes and scratches; but the sting of a bee, viewed with the same, will appear beautiful, without a flaw or blemish. A piece of fine muslin, or lawn appears like a coarse lattice, and the threads like ropes; the same with fine lace; but the thread of a silkworm or the web of a spider, will appear perfectly smooth. The smallest dot made with a pen appears a vast irregular spot, rough and jagged. Thus sink the works of art; but in those of nature, even in her meanest productions, nothing will be found but beauty and perfection.

What we know at present of things near and familiar is so little, that there remains a boundless space for our inquiries and discoveries in the works of nature; and the more we inquire into them, the more comprehensive and just will be our ideas of the power, wisdom, and goodness of the Creator.

The following is a list of the principal objects which afford the highest entertainment and instruction by the microscope. They may be divided into the following classes, viz:

I. Such as have their whole body, form, and parts magnified and exhibited in one microscopic view; as

The Louse; the Flea; the Bug; the Mite; the Eels in Paste, Vinegar, etc. the Animalcules in Fluids; very small Flies and Insects of all sorts; the smallest kinds of Plants, Mosses, Mouldiness, etc.

II. The small parts of animals, viz:

The Hair of the Head, Horse Hair, Mouse Hair, Hog's Bristles, etc. the Human Cuticle, or Scarf Skin; the Papillæ Pyramidales in the Skin; the Fibrillæ of Muscles, Nerves, etc. the Ramification of Arteries and Veins; the Lymphæducts, Lacteals, and other fine Vessels; the Blood, etc. the Circulation of the Blood in the Fins of Fishes, the Tails of Tadpoles, and of Wa-

ter Newts the best of all; the Nails and Hoofs cut into thin slices; the Plumulæ or Plumage of Feathers; the Pith of a Feather cut transversely; the Color and Tints of Feathers, Eggs, etc. of Birds; the Eggs of all kinds of Insects; the Antennæ or Feelers of Gnats; the Eyes of all Insects, Shell Fish, etc. the beautiful Head of a Flesh Fly; the Annuli or Rings, on the Bodies of Insects; the Wings of Gnats, Flies, etc. the Wings of Scarabæi, or beetles; the Wings of Butterflies, Moths, etc. the Sting of a Bee, Wasp, Hornet, etc; the Eyes of Spiders: the Exuviæ, or cast Skins of Spiders; the Apparatus in the Mouths of Spiders; the spiral Probosces of Butterflies, etc. the Teeth in the Mouth of a Snail; the Eyes on the Horns of Snails; young Spiders, Caterpillars, etc. just hatched; the Web of Spiders, Caterpillars, Silkworms, etc. the Chrysalides, or Cases of Insects; the Thecæ of Moths, Caddis worms, etc. the Scales of Fishes, Serpents, etc. the Scales of Eels in particular; the transparent Fins of Fishes and Eels; the Spiculæ, or Prickles, of Seal skins, the Ovaria, or Sperm of Fishes; the minute sorts of Shell Fish; the fimbriated Parts of Crabs, Lobsters, etc. the Excrements of Scollops, etc.

III. The third class of microscopic objects are of the vegetable kind.

The Plantule in the Fruit, or Kernel; the Corpuscules of the two Lobes macerated; the Orifices of Air vessels in the Roots and Branches; the Orifices of the Sap vessels in ditto; the Cortext or Bark of Trees in general; the vesicular Substance of Cork in particular; the ligenous Fibres in the internal Bark; the spiral Fibres of the Vessels in a Vine Leaf; the web-like Warp and Woof in rotten Wood; the Pith of Elder, and other like Plants; the transverse Section of Kex, Bramble, etc; the transverse Section of the Root of Fern, etc. the Involucra, or covering of Gems or Buds of Trees; the aromatic Balls on Leaves of Sage, Thyme, Mint, etc. the catenary Pearls on Sowthistle Leaves, etc, the Pellicle, or thin Skin of macerated Leaves; the Papillæ and Pores in the Pellicle of the Houseleek; the Particles of the Parenchyma of macerated Leaves; the Ramification of Vessels in ditto; the Duplicature of Vessels in ditto; the transparent Blades of Grass, Corn, etc. the Stings of Nettles, and their Juice or Liquor; the unguiculated Tenters, or Hooks of Clivers, etc. the Stamina on the young Shoots of Filbert trees; the Lanugo, or Down, on the Leaves of Plants; the small Flowers of Plants in general; the Colors of the Petela or Leaves; the Farina or Dust on the Stamina; the Style, Matrix, etc. in the Attire of the Flowers; the succulent pulpy part of the fruit; the small Seeds of Plants

in general; the Seeds of Fern, Hart's tongue, etc. in particular; the Seeds on the stems of mushrooms; the whole of sea Plants of every kind; the Variety in the Surface of Coralines; the Particular Texture of Sponge; the minutest Shells of every sort.

IV. The fourth class of objects proper for the microscope are of a miscellaneous nature, the principal of which here follow:

The edge of a Razor, Penknife, etc. the Point of a Needle, Pin, etc. the polished Surface of Metals; the Print, or Writing, on Paper; the Substance of Paper itself; the Contexture of Linen, Cloth, etc. the finest sorts of Sand; the Particles of different kinds of Earth; the various colored Particles of Mundick; the Surface and Substance of Ores and Metals; the Efflorescences of sparry Exudations; the Salts of Sea-water evaporated; the Salts of Vegetable Lixivia; the Salts of animal Substances, the Salts of Crystals of all Metals; the Crystallization of Salts; the Parts of the smallest Flakes of Snow; the hexagonal Cups of White Frost; the frosty Vegetation on Glass Windows; the Effervescence betwixt Acids and Alkalies; the ignited Particles in striking Fire; the Ashes of burnt Paper, Linen, etc.; the Teeth of fine Files, Rasps, etc. the Threads on the finest Screws; the Smallest Microscopic Glasses themselves.

PHRENOLOGY.

DR. SPURZHEIM'S LECTURES.

'Know then thyself, presume not God to scan,
The proper study of mankind is man.'

[Agreeable to a promise expressed in our last number, abstracts from the lectures of this distinguished Phrenologist are now presented. A concise view of the principles and foundation of the science having already been given, (No. ix. Vol. 2d) it is deemed unnecessary to repeat them, as laid down by Dr. Spurzheim, except in so far as he had given them a more vivid and interesting character. Many of the valuable remarks on education and those of a purely philosophical character have been omitted as not strictly adapted to a work devoted to Natural History.

From the necessity of frequently clothing the ideas in his own language, and the impossibility of incorporating the Doctor's manner and expression into the sketch, we are aware that the abstract is inadequate to convey any just idea of the intellectual treat, which a large and most respectable audience have so highly enjoyed, to those who have not participated.

The notes, however, are offered as, in some measure, illustrative of the interesting and important science of Phrenology.]

Phrenologists, dealing as they do, in spiritual subjects, state facts generally, more or less, and not with perfect precision as in the exact sciences. This necessarily results from the very nature of their science, but does not, in any degree, impair the confidence due to genuine phrenological deductions.

That philosophy of the mind which is called metaphysics, is unsatisfactory for three very cogent reasons. In the first place, there is little or no unaninimity among the metaphysicians. Some recognize the existence of a power in the mind, which others deny, and *vice versâ*. Hence there must be a radical error in the system, since the true philosophy must be universally and unalterably the same. Besides, the language of metaphysicians is variously interpreted, which renders the diversity of opinion still greater. But the chief objection to the old theory or rather theories of mind, is, that they are totally unsusceptible of practical application. Such surely would not be the case with a just and true analysis of the human faculties. Some of the most modern works indeed, are improvements upon the ancient speculations, and inasmuch as they are so, they are strictly phrenological. As long as we go with received opinions we are considered right; yet the rational method obviously is to go to nature, and observe, compare, and infer. We perceive therefore that the fundamental error of metaphysicians was that they prepared a system, in their closets, founded solely on individual consciousness. Dr. Gall proceeded in a manner diametrically opposite, but, like most philosophers at the outset of their systems, he committed some faults. One of the principal of these, was the habit of naming the powers from the actions. As the latter are generally the result of combinations and not of individual powers, this was evidently an inconsistent method. The effect of this procedure was also very prejudicial to phrenology, for Dr. Gall recognized an organ of thieving &c. thereby conveying an idea, that certain bad propensities were, in his view, inherent in our natures. The powers, however, in themselves are neither good nor bad, properly speaking; their design however is, like all the Creator's beneficent purposes, eminently and truly excellent. Their evil action is a perversion and not a legitimate effect.

Little need be said of the importance of an accurate and extensive knowledge of human nature to the medical man, the teacher, and the divine. Such a knowledge would produce a most complete but auspicious revolution in education and popular opinions; and such a knowledge the phrenologist confidently believes it in his power to afford.

In the first place, there are several familiar instances analogical

with phrenology. We know that there are peculiar temperaments, and that these affect intellectual development.

Thus, an individual having the lymphatic temperament, is slow in his intellectual operations, and instruction must be adapted to this condition of mind. The nervous temperament, on the contrary, so common in this country, uniformly co-exists with activity of intellect; while the bilious temperament is most frequently accompanied by an excellent judgment, but bad memory. Now the phrenologist perceives similar and remarkable correspondences between the mind and another physical portion, the brain; and he asserts that this cerebral part is the organ of the higher faculties, and absolutely necessary to their manifestation. Among the evidences on which he bases his theory are—that idiots and persons whose mental vigor has declined through age, are deficient in brain. Remarkable differences of mind, are observable in man, and a corresponding difference in cerebral organization. It is as impossible, however, notwithstanding certain prevalent notions, to measure the developments mathematically, as to attempt the same thing, in regard to the muscles or optic nerve; the size of which, is, by no means, proportional to their powers.

To the objection of medical men that the brain being impaired or injured, the mind still manifests itself, the phrenologist answers, that the brain is double, and consequently one organ may be destroyed while the other remains, and the mental operations will go on as when a like accident happens to one eye, ear, or olfactory nerve. Again, it is said, that skulls are not equally thick, and therefore no just idea can be formed respecting the cerebral development, by exterior measurement. If thick skulls or even unequally thick ones, were common, the argument would be more weighty; and when such instances are adduced, the history of the individual should be known, in order to enforce them. Phrenologists consider children, six months old, as subjects for observation; and experience has proved that important cerebral changes occur until the age of forty years. Among animals there is observable, throughout nature, a peculiar instinct which leads them to take care of their young. In some species this is only displayed by the female, in others by both sexes, as the canary birds, who share not only the labor of rearing, but also of hatching their offspring. This instinct is also universally prevalent among the human race. But there is a striking difference in this respect. Some mothers consider the care of their children as the greatest happiness, while others view the same duty as a burden. And there are persons who immediately take an interest in every little being they meet, while in other minds no such sentiment is exci-

ted. In persons thus, as it were, intuitively disposed to the care and love of children, the posterior lobe of the brain is always large. Even very young persons thus organized, must have a doll; and among animals, the like variation as to the feeling and corresponding discrepancy, as to the organ, is evinced. The monkey tribes for example, whose care of their offspring is remarkable, have the posterior lobe much elongated. The faculty is called *philoprogenitiveness*, and is generally larger in women than in men.

Animals are prone to remain in certain places, and in considering the cause of this, an interesting philosophical inquiry arises, viz. How far exterior circumstances are the cause of powers?—In education it constitutes an important subject of investigation, to discover what is derived from nature and what from circumstances. According to Phrenology circumstances never give talent, though they are important aids to its development, and in this, but in no other sense, is there truth in the saying, 'misery is the mother of invention.' Give materials to the beaver and he will build, yet obviously his instinct leads him to the act, though the materials were requisite. Had there been no French Revolution, there would have been no Napoleon.

Birds choose localities for their nests very variously. Some choose a bough, others a hollow tree, one a water-cliff, and another the cottage roof. The Hare, as is well known, manifests a strong attachment to the place of his nativity. These, and innumerable other instances of a like nature, occur throughout the animal kingdom. When we turn to man, we find this disposition no less evidently manifested, though in different degrees. There are wandering tribes, and there are those who settle at once and permanently. Some individuals desire to return to a distant home, though all friends and relations have long since departed. And an individual who attended the phrenological lectures on the continent, came six miles in the evening, for that purpose, but could not be induced to sleep out of his own house, even for one night. He had the part of the brain at the upper end of the occipital bone very much developed. This organ is more or less developed, according to the strength of the propensity, and is called *inhabitiveness.*

Among the means provided by the creator, for the preservation of the race, is a tendency among animals and men to defend their rights. This is evinced among birds when they return to their nests in the spring, and wage war with the hapless intruder who has pre-occupied them, and it is universally exhibited. The attempt has been made to attribute this manifestation to muscular power, which, it is said, inclines to vent itself in action. If

such reasoning was cogent, animals would incline to fight in proportion to their power. This however is not the cause. A wren will defeat a much larger bird; we often see a large dog run away from a small one, and a diminutive man is as pertinacious in asserting his rights, and as pugnacious in maintaining them, as a taller or more portly individual. Their explanation therefore is not satisfactory, and repeated observation proves the assistance of an organ, and also the inateness of this propensity. The representations of the ancient gladiators show this organ large in them, and also among the wrestlers. Among animals the horse presents an interesting subject of attention in this respect. In this country and in England shy horses are very common. In the latter remarkably so, which peculiarity is explained when we learn that narrowness of head is deemed a mark of beauty, and the race propagated on this principle necessarily have the organ small. It is remarkably small in very timid horses, and is called *combativeness.*

Phrenology, in common with all other sciences, has its difficulties. In examining the organs of the lateral region, for example, it is necessary to touch the head, not only on account of the hair, but also because of the intervention of muscles. We must likewise attend to the dimensions of the individual cerebral parts, in order to judge of the organs, for this consideration involves very important results.

No physiologist need be told, that short and voluminous muscles are more indicative of strength, than long and slender ones. We frequently see children who are remarkably active and unsusceptible of fatigue, but at the same time are incapable of lifting any considerable weight; this however is readily accomplished by a child having less general activity. In the former case, the muscles are long and slender, and in the latter short and thick.

The phrenologist constantly meets with analogous instances in regard to mental phenomena. There are individuals who are constantly reasoning, yet possessed of little depth of understanding, whose powers are ever active, yet accomplish nothing *great.* On the other hand, there are persons exhibiting very little mental activity, but when once engaged, produce grand results. Hence an elongation of the cerebral fibres is regarded by phrenologists as indicative of *activity*, and the contrary as evidence of ***energy*** or intensity in the mental powers.

In view of these and similar facts, great attention to the *limits* of the organs is obviously very requisite, in measuring the cerebral developments.

In proportion as the organs are necessary for the preservation of man, and the nearer they approach to animal instincts, the

farther back in the head they are situated. If a verticle line be drawn from the bony elevation behind the ear to the crucial spine or occipital protuberance, what lies between this line and the neck is the residence of the cerebellum. This cerebellum, or little brain, is the seat of the faculty called by phrenologists *amativeness.*

Men essentially differ in the evidence they give of worldly knowledge, a deep and acute insight into matters and things, and the ways and means of promoting their particular interests.

Again, there are persons who seem to delight in going round and round instead of coming to the point, who are very mysterious, and require a promise of secrecy before communicating every trifling or well-known circumstance. And there are those who deceive and lie without any apparent temptation, and upon whose representations no reliance can be reasonably placed.

Phrenologists regard these and similar phenomena as perversions of a very requisite faculty, which they denominate *secretiveness.*

There exists in the human mind a tendency to prepare for the future. And there are individuals who have never enough, whose chief happiness consists in acquiring, who exhibit a great fondness for collecting, not for any scientific or ostensibly useful purpose, but simply, as it would appear, for the sake of accumulating. They have an instinctive sense of utility, which effectually prevents them from forgetting self. They *feel* that charity begins at home. Instances are not few, in which persons, having a good education, manifest a strong desire to appropriate whatever they can conveniently lay hands on, and the circumstances of such individuals totally exclude the idea that want constitutes the actuating motive.

Furthermore, it is obviously requisite that men should be provident, look well to the actual advantage to be derived from certain actions, and, in short, exercise a prudent foresight. Hence we possess a faculty called *acquisitiveness.* Among the perversions of this propensity, the most common is theft. All inveterate thieves have the organ large.

A mechanical turn, as it is called, or a peculiar aptitude for those undertakings, requiring ingenuity and skill, is to a certain extent common among mankind, and is likewise evinced in the labors and habits of animals.

There is a wide difference among men, in regard to this faculty, some exercising great inventive, but no mechanical talents, others very awkward in their attempts; to draw, play upon musical instruments, construct, &c. and some engaging in em-

ployments of this nature with the greatest facility. To ascribe this tendency or its absence to any other than an inherent quality, seems as vain as it is unphilosophical.

The head of Canova exhibits the organ of this faculty very prominently, as do those of a boy who excelled in cutting likenesses and of the celebrated Raphael. The Esquimaux and South Sea Island Indians, afford interesting proofs of the contrariety both of the faculty and its organ, and the French milliners, who always give a tone to the fashionable world, possess it remarkably developed. Its phrenological name is *constructiveness.*

Society is obviously a divine institution, or one resulting from the constitution of men and animals; not a compact induced by the necessity or desire of affording mutual protection; for while the little magpies, after having paired, are the sole residents of one tree, the rooks and raven species, in general, dwell in almost innumerable companies, and the timorous hare occupies some favorite spot nearly isolated from his fellows.

There are men who seem to be naturally separated, by their peculiar mental constitution, from their fellow-beings; or, in other words, they do not readily, and in frequent instances, never, attach themselves to their kind with anything like warmth or permanency.

Children grieve at a separation from their nurses or familiar attendants and friends, and yet some perceive the change without emotion. The faculty thus indicated more or less powerfully is stronger in women than in men, and is styled *adhesiveness.*

Individuals are habitually careful or they are otherwise. The infant, when moved clings to the supporting arm of its mother and gladly seeks even the most frail aid to its first attempts at walking ; or, on the other hand, is remarkably bold and unconcerned.

Doubt, in the minds of many, opposes action, even after the most mature deliberation, and anxiety and watchfulness are often constantly active, and induce the frequent warning 'take care!'

Prompted by the impetus of feeling, some persons rush unthinking into action, others weigh and consider prior to the most comparatively trifling undertaking. Hope ever cheers the breast of one, and gloomy despondency darkens the path of another.

These and similar phenomena result from a greater or less development of *cautiousness*, an endowment at once necessary, and immeasurably useful to man and animals.

There are two fundamental feelings, which greatly influence our conduct. Their legitimate object is to direct us to the constant

performance of two of the most important of our moral obligations —our duty to ourselves and our duty to others.

The manifestations of the one—love of approbation, have received a variety of appellations. When evinced in efforts to attract attention by dress, manners or conduct, we call it love of distinction, in education it is styled emulation, and it shows itself in every variety of degree, from the fondness of what is called compliments, to the love of glory and fame. In Europe and this country it gives rise to numerous titles, etc. Boys are less anxious as to the opinion of others than girls.

There are people in the world who know everything. 'Twere a vain attempt to instruct them. Consequently they must always take precedence, and it would be presumptuous to question their right so to do. The first person I, is frequently used by them, and the affirmative, rather than the doubtful manner of speech, is particularly *their* habit. If insane, they are prone to imagine themselves kings. And such examples occur even in this country, and indicate the predominence of *self-esteem*. These two propensities combined create that peculiar susceptibility in regard to the behavior of others, called touchiness.

Phrenologists maintain, that man is naturally a moral and religious being; or, in other words, that he is endowed with certain feelings which lead him to morality and religion. If this be true, say many objectors, what need is there of a revelation? we answer great need. The powers which lead us to perform our duty in relation to the Supreme Being and to our fellow-beings are innate, but they require direction in order to manifest themselves legitimately and as they should. Therefore our heavenly Father has revealed himself and his will to us, and thus guided in their appropriate developments our moral and religious powers.

When we contemplate our physical organization and mental constitution, and see what infinite pains the Creator has taken to provide for our preservation, can we reasonably suppose that he has left to chance the most important of all our relations? certainly not; and accordingly we find that he has united us to himself by a strong tie.

The next question is—does the manifestation of these moral and religious faculties depend on organization? Phrenology says *aye*, and in this, as in every other case, appeals to observation.

Many dislike to admit, for a moment, the possibility of separating morality from religion. Yet common life affords innumerable instances of action predicated upon the truth, whether actual or supposed, of this very proposition. Witness the civil code

which solely refers to moral conduct, and observe how pertinaciously some men insist on *works* and others on *belief* as the condition of salvation. In reading the scriptures, it is surprising, how each marks the passage most congenial with his own views—which latter fact and numerous additional ones of a like stamp, suggests the important idea that religious feeling is not simple but combined. But phrenologists assert that there exists a fundamental feeling of this nature with its organ, which is called *veneration.*

Speaking generally, it is an easy matter to point out the distinction between man and animals, but when we come to moral feelings and reach the very line of demarcation, it is somewhat difficult to establish the distinction. There are some animals we call good, kind-hearted, &c. and instances unnumbered prove the existence of a mutual sympathy, between animals of the same and different species, which displays itself in a manner at once interesting and striking. Thus a dog has been known to convey hay to a cow, who could not reach it, and a fox in captivity was constantly supplied with food by his enfranchised companion.

The different degrees of benevolence or good-heartedness, are evinced even in infancy. Some children delight to divide their enjoyments, and others incline to a complete and isolated appropriation of whatever they obtain. And there are men ever ready to do good, and some *have no time* for it. This diversity is distinctly marked in the cerebral development as in habitual conduct. The size of the organ of benevolence being always commensurate with the relative power of that faculty in the mind.

Firmness is essential to success in every undertaking. Some men think long, but having decided, are immoveable. Others are swayed with the greatest facility. When carried to excess, firmness degenerates into obstinacy. It was large in Oberlin, and combined with veneration and benevolence enabled him to accomplish the noble enterprise which he so gloriously effected.

In making phrenological observations we should ever keep in view one important consideration, viz. that we are not to look at individual elevations and immediately deduce an inference; but first examine the different regions of the head, and see whether the occipital, lateral, sincipital, or frontal is most developed.

We have seen that the Creator has endowed us with the faculties of veneration and benevolence, but, in so doing, has he amply and completely provided for our constant and faithful performance of duty in relation to himself and our fellow-beings? Evidently not. And first as regards religion, we perceive the influence of a fundamental feeling essential to its growth, prevalence and power. If proof were wanting, the strong tendency to reli-

gion, manifested in this country, notwithstanding the absence of any legal provision and national institution, affords abundant evidence of the effect of the faculty under consideration. It shows itself in the love of the wonderful, and faith in supernatural agencies, so common among mankind. Missionaries frequently complain of the attachment evinced by savages to their sorcerers. The Romans generally attached a momentous importance to the direction of the flight of a crow. We speak of Johnson as superstitious, and there is a very well educated individual abroad, who actually suffered, if by chance a pin should fall point towards him. It is very common to meet with persons prone to attach an extraordinary meaning to every trifling event. Observe the great practical result of an admission of this truth. It explains many of the diversities among christians, since those who 'hear an inward voice,' and admire the mysticism of certain doctrines, feel this from a predominance of the faculty entitled marvellousness, but while they act from this impulse, they cannot in view of its spring denounce others who, from their very constitution, cannot sympathise with them. Martin, who was arrested in London for setting fire to the cathedral, and who declared he was incited to the act by a voice within him, had the cerebral part where this organ lies strongly marked. And Dr. Priestly and Price who could never agree, and never would have agreed, exhibited a corresponding difference in respect to this faculty. The feelings in themselves are blind, and any one who acts solely from their impetus will necessarily err. The Creator has taken care of us, and given us understanding as a guide. The phrenological system considers the powers of the human soul as two-fold intellectual and affective; the essence of the former is *to know*, of the latter *to feel*. Thus the appetite simply induces us to take food, but it is the part of the understanding to direct our choice in selecting it. Veneration inspires a disposition to reverence, without specifying its object; and cautiousness induces a prudent regard for our safety and well-being; yet if unenlightened we might, under its influence, fear even our own shadow.

Most philosophers, from Aristotle to Locke, ascribe the commencement of mental activity to external impressions, derived through the medium of our senses. Phrenologists, on the other hand, maintain that the mind acts through the spontaneous incitement of the affective powers, and that mental activity does not depend upon the senses. The senses do not produce the intellect, and we cannot measure mental capacities according to the senses. For we find many animals much more acute than man, in regard to their senses, yet how infinitely inferior as respects

higher endowments. Yet some philosophers refer most of the wonderful effects, attributed to the senses, to the touch alone. 'Man,' say they, 'is furnished with very delicate nerves at the extremity of his fingers,by the use of which he is brought into intimate acquaintance with external objects, and thence his mind is excited to action; while the animals, being covered with hair, are not possessed of so susceptible a sense of touch.' This intervention of hair does not, however, afford a satisfactory proof of this desideratum as applied to animals, and besides there are numerous instances of the spontaneous activity of the mind, without the aid of the senses. In Scotland there is an interesting example. James Mitchell was born blind, and deaf, and if now living is thirty-five years of age. His intellect has ever been remarkably active. He soon became acquainted with persons and things, and liked or disliked the former, forming his sentiments solely by the sense of smell. He had *secretiveness* very large, and when quite a lad was fond of shutting others in a room. His sense of property was also remarkable: he once met an individual on his father's horse, and immediately made signs for him to dismount. He was fond of smoking, having acquired the habit when quite young. He was allowed however but four pipes a day, but when absent from home, he often obtained additional pipes, which he enjoyed after his customary quantum had been allowed, exercising all due caution in the matter. He used *destructiveness* to evade certain employments which were occasionally assigned him, and having once ventured to crawl over a board which bridged a deep stream near the house, his father employed a strong man to watch, and when he repeated the experiment, to tip the board and then rescue the child; thereby giving him a sensible warning of his danger. He so well remembered the lesson that a year afterwards, when a playmate offended him, he took him in his arms, and dowsed him into the stream. There is, as is well known, a young lady in Hartford Asylum, Conn. 28 years old, destitute of hearing and sight, who yet performs many skilful operations, has a particular friend of her own selection, dresses her hair by feeling of the head-dresses of the ladies about her, and following the mode she likes best; and moreover, recognises her property, distinguishes individuals, &c. by the sense of smell.

The senses do not acquire their functions from one another. Each sense has its peculiar function, and one cannot beanother. rectify another except in a general sense. Each sense gives us a notion different from the other, and we all know that in order satisfactorily to ascertain the qualities of substances we habitually use

all the senses. Again, our senses are not sufficient to give us notions of the world. For one person with excellent eyes may be far less observing than one possessing very poor ones. There are therefore certain internal faculties, necessary in order to use the senses, and there are corresponding cerebral organs. The seat of these is the frontal region. The forehead presents difficulties, on account of the occasional existence of holes or frontal sinuses, as they are called, in the anterior lobe of the brain. These however do not occur in children. The *Antiques* recognised the forehead as the seat of the intellect. In the statue of Apollo it is very large. It is not to be judged of solely by its perpendicular or retreating aspect, nor to be viewed in front, but observe the individual's profile and see how the forehead projects from the temples. Some philosophers maintain that the senses are sufficient to acquaint us with the physical properties of things. The fallacy of this idea is rendered very evident by observing the striking difference in degree with which individuals use their senses. Children who receive what is styled their first education in such a manner as to bear away from school the title of *dunces*, not infrequently manifest, in practical life, where they are engaged in self-education, an acumen and successful application quite astonishing. In treating of the faculties of the mind, we cannot follow the metaphysicians, but the powers which they deem fundamental, phrenology ascribes to the action of the individual faculties. Thus any power when active desires gratification, and accordingly *will* is exercised by each faculty, and does not form a separate constituent element of mind. The intellect desires notions, and it is interesting, in this matter, to observe the admirable provisions for human welfare. For, what notions are most requisite for us in early life? Notions of things about us, undoubtedly. And we find that children evince a strong desire for a knowledge of external objects. Furthermore, the power of this tendency depends on the cerebral part at the lower part of the forehead, just above the root of the nose. It is observable that this organ of *individuality* gradually comes out after the age of six weeks. It produces a habit of looking, is the occasion of curiosity, and is generally small on account of the general inconsistency and ignorance of mankind. There are several concomitant exterior diversities, such as breadth between the eyebrows, the angle of the eye, and the direction of the eyeball. Naturalists have the organ large, the eyebrows and eyes far apart, and the intermediate cerebral parts strongly developed.

The organs called by phrenologists, *size*, *form*, *color*, and *weight*, have likewise their residence in the frontal region, and in pro-

portion to the dexterity and taste of individuals in regard to these properties, the organs are severally developed. *Eventuality* is expressed by the verb, as individuality is by the substantive, and it is remarkable that Horne Tooke, who proposed that the parts of speech should be reduced to two, viz. the substantive and verb, had these two organs very large. This faculty induces a love of facts, events, stories, &c. It is situated immediately above individuality.

The poets have given beautiful descriptions of *Hope*. Religion admits it, and we readily recognize in the existence of this faculty, a most beneficent provision for our happiness, deprived of which the joys of life would no longer afford pleasure, and its sorrows be unsusceptible of mitigation. It is found that individuals greatly differ in respect to this faculty. There are the *optimists* ever cheerful, and those who constantly fail in plans only to enact new ones on their ruins, and start again with renewed *hope;* these we call the schemers. Circumstances auspicious in the highest degree, inspire no felicity into the minds of some. A settled gloom darkens the path and obscures the sunshine of happiness. These possess little hope, and the cerebral part ascribed to this organ is small; while in the former class it is strikingly large.

The existence of a moral sense has been a disputed proposition, and many still doubt it, while others strenuously maintain that there is in man an internal monitor, which directs his conduct, and punishes or rewards him according to his deeds. The civil law, however, does not leave the punishment of crime to this conscience, as it is termed. From which, as well as from the fact, that many excellent men aver that they have and do experience effects attributed to it, we infer that it exists, but, like the other faculties, in various degrees. It is not however defined by phrenologists as an absolute and sure guide in right conduct, but it occasions a *desire* to know the right and to do it. It is large in children, who avowedly have an acute sense of the justice of conduct, and it is found to diminish as they advance in life. This may be ascribed to want of cultivation. While some address the love of approbation, and others self-esteem, to induce virtue, and while many are martyrs to acquisitiveness, vanity, &c. how few appeal to the *sense of right* innate in the child, or measure their own actions by the standard of justice within them! *Conscientiousness* is obviously as necessary to benevolence as marvellousness is to religion. It is small in most criminals, and in view of its powerful influence merits the profound attention of the divine, moralist and teacher.

Some religious persons dislike to see powers destined to give

us cheerfulness, in successful action. Yet there are such powers, their object is as beneficent and good as all the other designs of the Creator, and their legitimate gratification is alike due to nature and intimately connected with the advancement of the best interests of humanity. And first there is poetry. 'The poets are born,' is an ancient expression, and the variety manifested by them, in the development of their peculiar faculty, is phrenologically explained by its combination. They evince it in childhood, and are disappointed to find real life so very different from their fond imaginings. A poetical vein runs through their letters, conversation, descriptions, &c. There are poets among the artists. The painters who are said to flatter their likenesses are poets, they must picture men and things as they should be, and not as they are. Herein, indeed, is the difference between poets and others. The former view nature and society through a lens which robes them in an ideal perfection, while others look on and see the plain, strait-forward, common things and ways of the world. The ancient statues of poets have *Ideality* large, and Homer excells, in this respect, every representation which has descended to us.

Some men try to be wits, but they try in vain. Others are so much so, that even the desire to spare their friends will not confine the jest. Painters show it by caricature, composers of music throw it into their airs and melodies, actors evince it by ludicrous mimicry, and those having it greatly manifest it according to their other faculties. It is frequently the vehicle of ideas, and those who have no ideas, cannot, of course, be witty. Voltaire had it so much, that even holy things suggested to his mind laughable images. His use of the faculty was evidently a perversion.

The faculty called *Imitation* is peculiarly necessary in the first stages of infant education, and hence we find children largely endowed with it. In adults it is comparatively small, but some, as artists, actors, &c. cultivate it, and therefore have it generally full. It is indeed very requisite in the fine arts, and is an important means of improvement.

Memory, according to the metaphysicians, is a fundamental power; the phrenologists, on the contrary, consider it as a state or condition of the several faculties, in the same manner as attention. On this principle, the various manifestations of memory are explicable. We all know that some individuals easily remember the places where they have once been, others the dates of events, and others a different circumstance relating to the same subject. In short one person has a good memory for one thing, and anoth-

er for another. Phrenology refers these phenomena to a modified action of the different faculties. Thus an individual who has the organ of form large, will readily recollect this quality of an object he has once seen, while all the others have escaped his remembrance. And a retentive power of mind will in all cases be evinced, corresponding to the development of the different faculties.

An interest in localities, a desire to observe them, and a skill in becoming acquainted with them, is particularly observable in some men. There is at present abroad an Irishman, who annually travels for no other purpose than to look about him, and a blind gentleman, well known to many, goes about accompanied by a servant, who gives him an account of the hills, rivers, &c. which they pass. These he carefully remembers, and thence derives a great degree of pleasure. In these, and individuals of a like character, the organ of *locality* is very large.

The diversity exhibited by children with regard to numerical operations is striking. Some find their chief amusement in counting, and will embrace every opportunity to numerate the objects presented to them, others have no like inclination ; hence a fundamental faculty, depending for its manifestation on a cerebral part, styled the organ of number. Important considerations result from this phrenological fact. It seems plainly to point out the fallacy of expecting by the extensive introduction of mathematics into education to expect to create great mathematicians. Such a result is indeed only effected by the combined and vigorous action of several powers ; but one deficient in the organ of number, may reason admirably on some subjects, but will fail if great numerical calculations are expected from him. Number itself simply gives a facility for counting, and may exist in one very deficient in reasoning powers. A lad who had it strong, was taken to see Garrick, in a fine piece, and when the play was over, merely evinced the impression made on his mind, by stating the number of syllables which the distinguished actor had pronounced during the performance.

[The preceding article was prepared for the press before the melancholy termination of Dr. Spurzheim's labors. We believe that his death may justly be ascribed to the devotedness with which his objects were pursued. He indeed fell a victim to his deep sense of duty. It is with sincere regret that, on account of the pre-occupation of our pages, we are obliged to deny ourselves the gratification of recording, at length, the life, labors and noble character of the great departed. His efforts in the most important, but least appreciated province of Natural History, with their splendid results, constitute the noblest monument, which even sorrowing friendship could rear. That these may be felt and valued as they should be, and the admirable example they bespeak produce its legitimate results is the fervent prayer of every enlightened friend of humanity.

'He had, for reasons of which we are not informed, selected Boston as the first place in the United States, in which he should exhibit the claims made on behalf of the new science, originally promulgated by his friend and master, Dr. Gall, and afterwards extended and materially improved by himself; and the kindness and regard with which he was received in every circle, were as warmly reciprocated on his part. If ever man found sincere friends out of his own country, we are sure, that this illustrious stranger had many such among us. Indeed, it would have been a reproach, if he who was the friend of all his fellow men, should not have found here, some of the human family who would feel towards him as his own benevolence merited.

'The science which he had so successfully cultivated,—*the science of man*—had, as he often observed to his friends, elevated and refined his views of human nature; and he believed it had preserved him from declining into a feeling of misanthropy and dissatisfaction with the world; a tendency to which, we imagine, might have been strengthened by the sense of solitude which he had peculiarly felt ever since the loss of his wife, who died about two years ago. Whatever may have been the cause--whether it were his natural temperament, or the cause here stated, he manifested a philanthropy not surpassed in any age; and he was a living example of the beautiful sentiment of antiquity—Homo sum, nihil humani a me alienum puto.]

STRUCTURE OF THE EARTH.

[From 'the First Lessons in Natural History.']

All geologists are agreed that our present continents were once covered with water. This is proved by the remains of marine animals imbedded in the strata which lie on the summits of the highest mountains. The structure of the globe as far as we are acquainted with it from the intersections made by rivers, by the action of the sea upon the coast, and by mining operations, consists of beds of different kinds of stone, which generally increase in thickness as we descend deeper. Stratification, in its simplest form may easily be conceived, by placing a closed book with the back resting upon the table, and raising the opposite edges a little; the book may represent a thick mineral bed, and the leaves a series of strata. In nature we frequently find the strata much broken, and thrown out of the original position. Where any series of strata are wanting, a question naturally arises, have they been carried away by some sudden inundation, before the upper strata were deposited, or have they never extended to that place? In some instances it is certain that the strata have been carried away from particular situations, as in some of the excavations which have formed valleys, in which the strata that terminated on one side of the valley may be discovered again in the hills on the opposite side. The substances of which the strata are composed, are argillaceous, calcareous, or siliceous earth, which are generally more or less intermixed or combined. The strata of clay,

or argillaceous strata, being water-tight, give rise to springs, as arrest the water that runs through the porous strata, and convey it to other situations. The inclinations of the strata, with the breaks and inequalities, render the globe habitable, by distributing the waters over the surface.

According to geologists, all the substances which now constitute rocks, mountains, and soil, on the surface of the earth, were originally existing in a state of solution in the waters of the 'great chaos.' It is supposed, that they, at the beginning surrounded the globe at a great depth. The substances or materials of rocks thus swimming in the primitive ocean were supposed to fall gradually to the *bottom*, sometimes by chemical, sometimes by mechanical means, and sometimes by both together; and in this manner all the rocks were formed which we now find on digging into the earth. The inequalities of mountains and valleys on the surface of the earth, which were thus produced as soon as the waters began to subside, gradually rose out of the primitive sea, and formed the first dry land. The rocks which were first formed in this manner are called *Original or Primary Formation;* because no fossil remains of animals or vegetables, nor any fragments of other rocks were found imbedded in them; hence it was supposed that they were formed before the creation of organized beings. The rocks of this class, are for the most part extremely hard, and the minerals of which they are composed are frequently more or less perfectly crystallized.

The formation of these rocks, however, did not, it seems exhaust the materials floating in the waters, for the deposition went on, and a class of rocks were formed called *Intermediate or Transition Rocks;* because, on their appearance above the water, the earth was supposed to pass from an uninhabitable to a habitable state, for nearly all the rocks contain organic remains of the lowest class of animals, which are considered as forming the first link of the chain of animated beings. They contain also fragments of rocks of the primary class, and are frequently interposed between those of the primitive and secondary formations, and often partake of the characters belonging to both. The rocks of the primary and transition classes are the principal repositories of metallic ores. Rocks of the transition class, however, are not universally interposed between the primitive and secondary ones, for in some instances the transition series are entirely wanting.

After the formation of the primary and transition rocks, it is supposed that the water suddenly rose over them to a great height covering them in many places, and it again subsided with a new formation called *Lower Secondary Rocks.* They are nearly all

distinctly stratified, and contain an abundance of fossil remains of vegetables, analogous to ferns, palms, and reeds; while those of the transition class, contain almost exclusively the remains of marine animals.

After these changes, another most remarkable revolution of the globe took place, and another class was formed called the *Upper Secondary Rocks.* The organic remains of the strata of this class are chiefly those of marine animals, but of different genera and species from those of the transition class. It is in the rocks of this series that we first meet with remains of animals of a higher class, which possessed a brain and a back bone; they are all of the oviparous order, such as the fish or lizard tribe. This upper series appears to have been formed not only under different circumstances from the lower, but after a long interval, during which the surface of the globe had been much fractured and displaced; for the upper series do not lie regularly upon the other, and parallel with them, but they cover the edges of the lower strata in a confused manner.

*Tertiary** *Strata* comprise all the regular beds which have been deposited subsequently to the chalk strata, on which they frequently repose. It was formerly supposed that tertiary strata were very limited in extent, and were confined to a few districts in Europe; recent observations, however, prove that strata of this class cover considerable portions of the surface in various countries, though there are other countries in which they are entirely wanting. Tertiary strata are the last formed or uppermost of all the regular rock formations. They consist chiefly of clay, limestone, and friable sandstone ; the lower series of these strata contain numerous marine shells, while some of the middle and upper strata contain shells resembling those found in our present rivers, or in fresh-water lakes. The most remarkable fact respecting the tertiary strata is, that some of them contain numerous bones of quadrupeds of the class mammalia, but these for the most part belong to genera and species which no longer exist upon the earth.

Volcanic and Basaltic† *Rocks* have been either ejected from volcanoes, or poured out in a state of fusion from rents and openings of the earth's surface. They cover in an irregular manner the rocks of the preceding classes. In some situations the melted mineral matter has taken a columnar form in cooling; in other situations it fills vast fissures, called by miners, *dikes.*

* Derived from the Latin, *tertius*, third.

† Derived from the French *basané*, tawny, alluding to the color of some of the varieties.

Alluvial or Diluvial‡ is caused by the wearing down of the rocks, by the action of the weather and other causes, and the washing away of the worn materials by rains and streams of water. Considerable portions of many countries are covered with thick beds of it, which consist of beds of sand or clay, fragments of rock and loose stones, more or less rounded by attrition. In some situations these have evidently been transported from a vast distance, for frequently no rock similar to the fragments occurs within a hundred miles, or more, of the place where they are deposited. They indicate the action of mighty inundations which have swept over the face of our present continents.

The classes of rocks above enumerated have their appropriate mineral productions, and with the exception of rocks of the first class their appropriate organic remains; and it would be as useless to search for regular beds of common coal in the primary rocks, as it would be to search for metallic veins or statuary marble, in the tertiary strata.

The following plate represents a section of the earth between 40° and 45° north latitude. Fig. 1 denotes the primary formation; 2, transition; 3, the lower secondary; 4, the upper secondary; 5, tertiary; and 6, alluvial or diluvial formation.

‡ Alluvial is derived from the Latin, *alluvia*, an inundation of water. Diluvial is from the Latin, *diluvium*, the deluge or flood.

METEOROLOGICAL JOURNAL,

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[From the Daily Advertiser.]

	THERMOMETER.			BAROMETER.			FACES OF THE SKY.			DIRECTION OF WINDS.			RAIN.
Day.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Morn.	Noon.	Even.	Inches
1	57	58	56	29.90	29.85	29.72	Cloudy	Rain	Rain	N. E.	N. E.	N. E.	0·78
2	56	64	55	29.73	29.78	29.78	Fair	Fair	Fair	N. E.	E.	S. W.	
3	49	60	54	39.74	29.80	29.82	Fair	Fair	Fair	N. W.	N. W.	S. W.	
4	50	64	57	29.82	29.83	29.86	Fair	Fair	Fair	S. W.	S. W.	S. W.	0.10
5	50	68	58	29.97	30.00	30.00	Fair	Fair	Fair	W.	W.	W.	
6	48	58	50	30.00	30.00	29.98	Cloudy	Fair	Fair	N.	N. E.	E.	
7	46	59	52	29.95	29.95	30.02	Cloudy	Cloudy	Rain	N. W.	E.	S. E.	
8	50	62	50	30.10	30.19	30.28	Fair	Fair	Fair	N. E.	E.	S. W.	0.15
9	42	58	50	30 35	30.35	30.35	Cloudy	Fair	Fair	N. W	W.	S. W.	
10	48	48	63	30.25	30.10	30.00	Cloudy	Rain	Cloudy	S. E.	S. W.	S. W.	0.04
11	70	65	52	29.81	29.79	29.90	Cloudy	Rain	Fair	S. W.	S. W.	N. W.	0.68
12	48	64	50	30.02	30.09	30.12	Fair	Fair	Fair	N. W.	N W.	N. W.	
13	48	70	57	30.12	30.12	30.10	Fair	Fair	Cloudy	N. W.	S. W.	S. W.	
14	48	57	41	30.05	30.05	30.19	Cloudy	Cloudy	Fair	N. W.	N.	N. W.	
15	35	38	38	30.35	30.38	30.38	Fair	Fair	Fair	N. W.	N. W.	N. W.	
16	35	45	46	30.38	30.28	30.25	Fair	Fair	Fair	S. W.	S. W.	S. W.	
17	48	69	57	30.22	30.15	30.12	Fair	Fair	Fair	N. W.	S. W.	S. W.	
18	56	72	66	30.11	30.10	30.11	Fair	Fair	Fair	S. W.	S. W.	S. W	
19	52	52	50	30.34	30 35	30.28	Cloudy	Fair	Cloudy	N. E.	N. E.	N. E.	
20	56	73	57	30.10	29.95	29.92	Cloudy	Fair	Fair	S. W.	S. W.	S. W.	
21	55	60	54	30.10	30.15	30.29	Cloudy	Fair	Fair	N. W.	N. W.	N.	
22	50	52	46	30.35	30.32	30.10	Cloudy	Cloudy	Rain	N. E.	N. E.	N. E.	
23	51	59	52	29.79	29 75	29.90	Cloudy	Cloudy	Cloudy	N. W.	N. W.	N. W.	0.67
24	42	50	40	30.05	30.10	30.09	Fair	Fair	Fair	N. W.	N. E.	N W.	
25	40	52	33	30.03	30.05	30.18	Fair	Fair	Fair	N. W.	N. W.	N. W.	
26	28	42	30	30.40	30.45	30.50	Fair	Fair	Fair	N. W.	N. W.	N. W.	
27	32	52	44	30.37	30.22	30.21	Fair	Fair	Cloudy	S. W.	S. W.	S. W.	
28	40	42	42	30.20	30.21	30.25	Cloudy	Cloudy	Cloudy	N.	N.	N.	
29	36	50	38	30.29	30.32	30.38	Fair	Fair	Fair	N. W.	N.	N. W.	
30	34	60	42	30.38	30.38	30.39	Fair	Fair	Fair	S. W.	S. W.	S. W	
31	40	62	46	30.34	30.31	30.25	Fair	Fair	Fair	S. W.	S. W	S. W.	

Depth of rain fallen 2.42 inches.

Hours of observation, at sunrise, 1 o'clock, and 10 P. M.